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TITLE: The Impact of Western Technology on Poland's Economy: 1970-1984

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chemicals and metallurgy, the imported western technology did not generate the expected gains in productivity.

The macroeconomic (input-analysis) indicates that Poland followed a rather risky strategy in the 1970's by promoting sectors with high import content and often low linkage effects. Our calculations suggest that in the early 1970s demand stimulating policies should have been geared primarily towards metallurgy, food, agriculture, light industry and construction. The relative neglect of agriculture may have been the single most important omission of the supply-oriented policy.

Introduction

The present report summarizes the results of a two-year study undertaken jointly by Jan Svejnar and Katherine Terrell of Cornell University, Kazimierz Poznanski of Rensselaer Polytechnic Institute, and Joanna Gorecka Poznanski of Skidmore College. The research project focused on the specific issue of the effects of Western technology imports on the Polish economy and on a more general issue of what would have been the optimal economic (industrial) policy in Poland in the 1970s and 1980s.

Chapter 1 of the report provides a general survey of the major economic and political developments since 1970. Chapter 2 presents microeconomic evidence on the extent of Western technology imports and their impact on hard-currency exports and efficiency. Chapter 3 reports the results of a sectoral analysis which assesses the impact of western capital imports on the total factor productivity of nine major Polish industries. In contrast to the microeconomic and sectoral supply-side analyses of chapters 2 and 3, chapter 4 uses the 1969 and 1977 Polish input-output tables to establish which industries ought to have received priority from the standpoint of a demand-oriented economic strategy.

Chapters 1 and 2 were written by Kazimierz and Joanna Poznanski, chapter 3 by Katherine Terrell and chapter 4 by Jan Svejnar. Richard Chaykowski, Luc Leruth, Robert Moore, Pierre Nicolas, and Magdalena Okulicz-Koziren provided valuable research assistance. The authors also greatly benefitted from data supplied by Stanislaw Gomulka and Jan Vanous as well as from discussions with George Staller, Zbigniew Fallenbuchl, and Bozena Leven. Any errors are the authors' responsibility.

1. Overview of the Polish Economy Since 1970

The purpose of this chapter is to provide a general picture of major developments in the Polish economy since 1970. In particular, an effort is made to identify the factors that have led to the current economic crisis and the forces that prevented Poland from entering another period of sustained growth. We believe that only within such a broad context can one properly assess the impact of western technology imports on the growth performance of Poland's economy.

The authors recognize here that the expansionary policy which Edward Gierek selected in 1971 - not much different from the policies of many other leaders in Eastern Europe - would have resulted in serious economic crisis in any case, one evidence of this being the fact that such aggressive investors as Hungary and Romania have ended up in deep economic difficulties as well. However, it was the inability to pursue the necessary adjustments once the economic risks were recognized that worsened the crisis and made Poland the worst case in Eastern Europe.

Moreover, it is argued that unresolved political tensions have prevented the regime from introducing an adequate rescue package at critical times. The Polish experience as well as the experience of other Eastern European countries show that the economies in the region are equipped with a remarkably powerful stabilizing mechanisms that help them restore macroeconomic equilibrium quickly (though in a costly fashion). But these

mechanisms work only under conditions of political stability that allow the regimes to enforce unpopular measures without undermining their ability to govern the economy. Poland is the only case where this requirement has not been met during most of the adjustment period.

1.1 The Expansion Program of 1971-1975

When Edward Gierek took over as First Secretary of the Polish United Worker's Party (PUWP) at the end of 1970, the Polish industry was stagnating and losing its technological edge in the world economy. Moreover, years of deflationary income policies had had a detrimental impact on labor productivity and work discipline. Gierek's first response established limited corrective measures (most of them in agriculture), followed by a set of far more radical moves which laid the foundations for the economic expansion of 1971-1975.[1]

Investment Program. In this respect, the outstanding feature of the new economic policy involved a decision to accelerate investment in an unprecedented build-up of production capacities. By 1975, the volume of investment exceeded the 1970 level by 133 percent. By that time, the share of investment in the national product soared above 25 percent (e.g., 29.0 per cent in 1975 versus an average of 19.4 percent for 1965-69). This spurt was much stronger than that in any other East European country at that time. Even Romania, with its aggressive growth policy,

reported an increase in total investment of about 72 percent. Only in Hungary did the share of investment in national product approach that of Poland, but even there the increase in the level of total spending was not so abrupt as in Poland.[2]

The decision by Gierek radically to speed up the investment program was in part due to the logic of central planning, under which industrial units - from enterprises up to ministries - continually seek to push investment as high as possible. Normally, however, national leaders responsible for the economy as a whole have an interest in restraining such in-built 'expansion drives' and 'investment hunger' on the part of the individual industrial units, insofar as the national economy faces 'hard' budget constraints (e.g., shortages of hard currency to pay for foreign equipment, limited physical capacity of the construction industry). In Gierek's case, no such interest in restraining the pressure on investment appeared at that time.[3]

Instead, acceding to administrative pressures represented a critical mode of buying support among important political actors in the state bureaucracy. In fact, Gierek's assumption of the post of First Secretary in Poland was accompanied by the elevation of a large number of activists with strong industrial backgrounds. They showed much less concern for overall economic balances than had the previous leadership elites. Almost none of the top leaders under Gierek stood for the same qualities as the old 'watchdogs' of balanced plans under Boleslaw Bierut (e.g., Minc and Szyr), or Wladyslaw Gomulka (e.g., Jedrychowski and

Jaszczuk).

Incomes Policy. Another important policy change was a decision sharply to accelerate the growth of real income compared to the period 1966-1970, when real wages had grown slower than elsewhere in Eastern Europe. This target had to be achieved with relatively stable prices, a constraint virtually forced upon Gierek by the industrial workers. Ironically, although the price rise Gomulka imposed in 1970 was a prime factor in Gierek's rise to power, the latter initially resisted workers' demands to roll back the price increases. However, faced with massive strikes in Lodz in February 1971, he restored the old prices and promised not to raise the prices for necessities over the next few years.

As things turned out, the actual growth in incomes greatly exceeded the initial plans for a rapid improvement in consumption. In 1971-1975, nominal wages were allowed to increase on average by 9.6 percent yearly, more than three times the original plan figure (Table 1). The annual rate of growth of real wages was around 6.8 percent, several times above the level permitted under Gomulka. The latter rate was more than twice the rates in the two other Eastern European countries that adopted models of 'consumer socialism', namely East Germany and Hungary. These wage increases resulted from both the unexpectedly high rate of growth in revenues of industrial associations and from the centrally instituted reforms in wage schemes of particular trades and in the retirement system.[4]

Table 1

Basic Economic Indicators, 1970-1980
(percent growth from previous year)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
1. National product	5.2	8.1	10.6	10.8	10.4	9.0	6.8	5.8	3.0	-2.3	-6.0
2. Industrial output	8.1	7.9	10.7	11.2	11.4	10.9	9.3	6.9	4.9	2.7	-0.2
3. Agricultural output	2.2	3.6	8.4	7.3	1.6	-2.1	-1.1	1.4	4.1	-1.5	-9.6
4. Investment	4.1	7.4	23.0	25.4	22.3	10.7	1.0	3.1	2.1	-7.9	-10.5
5. Investment/ National product ratio	20.5	20.6	23.3	25.9	28.3	29.0	27.0	27.1	25.9	22.7	17.3
6. Employment	0.6	1.9	2.6	1.9	1.8	0.6	0.0	0.6	3.0	0.5	0.6
7. Labor productivity	5.5	5.7	5.6	8.5	9.5	10.0	8.8	6.2	2.7	-2.0	-1.0
8. Nominal wage	2.8	5.3	4.7	9.1	14.3	13.6	8.8	7.1	5.6	9.1	12.8
9. Cost of living	1.2	-0.2	0.0	2.6	6.8	3.0	4.7	4.9	8.7	6.7	9.1
10. Real wage	1.6	5.5	4.7	6.3	7.0	10.3	3.9	2.1	-2.9	2.2	4.0
11. Real wage productivity ratio	x	0.96	0.84	0.68	0.70	1.03	0.43	0.33	-1.12	x	x

Sources: Rocznik Statystyczny, GUS, (Warszawa: GUS, various years).

In this respect, Gierek's willingness to provide for a rapid income expansion was very different from the behavior of other incoming party leaders in Eastern Europe. To be sure, new regimes traditionally try to gain popularity by allowing incomes to grow faster than under their predecessors and by allocating more resources to consumer goods industries; Gomulka followed precisely this strategy during 1956-1957. Traditionally, too, the favorable income policy does not last long, since other conflicting pressures allow the now-established leadership to withdraw its commitment to consumption (e.g., 1961-1965 under Gomulka). However, in the case of Gierek, the decision to allow consumption to grow was (or was perceived to be) a long-run commitment, partly forced on him by the high level of political leverage achieved by the workers at that time.

The new political philosophy of the recently arrived ruling elite also favored such concessions. It was a rather unorthodox approach, calling upon the party to 'earn' the acceptance of its authority not just through a nagging indoctrination and threats but rather by responding to the needs of people (i.e., consumer aspirations). In fact, Gierek had tried this approach successfully in Silesia, long before his appointment as PUWP First Secretary. Reportedly, Silesia contained both the best supplied shops in the country and the most disciplined work force when Gierek was party leader there. Similarly to investment, then, wage and price policy represented an adjustment in economic plans designed to capture the support of what were important

strategic political actors, in this case the industrial workers.

Western Assistance. Such a rapid jump in investment paralleled by sharp increases in consumption, for all practical purposes required western financial assistance. Credits from the West were also needed to provide the booming economy with modern technology, not available in the Soviet Union or elsewhere in East Europe. Gierek - unlike his predecessor - did not hesitate to open the economy to outside contacts. This interest coincided with the ongoing effort by Western countries to stimulate sales of products in East Europe and the Soviet Union through liberalization of technology restrictions[5] and generous credits, both radically intensified after the 1973 oil price shock.

The regime took full advantage of existing external opportunities. By 1971, Poland still showed a positive balance of trade with Western countries, but later it entered into large deficits. The single sharpest change took place in 1973, reflecting a sudden increase in the accessibility of Western credits. Accordingly, the net debt to the West increased rapidly from an easily manageable sum of 1.2 billion dollars in 1971 to 7.6 billion dollars in 1975 and 20.7 billion dollars in 1979 (see Table 3). Although similar strategies were adopted by other East Europeans - and with clear encouragement from the Soviet Union - none except for Romania pursued borrowing as aggressively and as early as Poland.

One of the internal reasons for this more aggressive Polish

borrowing policy was an attempt by Gierek to use closer economic contacts with Western countries to emancipate himself to a degree from the political control of the Soviet Union. Unlike many other leaders in East Europe, Gierek had not been mandated by the Soviet Union but rather internally elected by the Polish party, due to his successful effort to build a coalition to undermine his predecessor Gomulka. This gave Gierek the domestic base necessary to pursue a more independent political line, which would appeal to the traditionally strong nationalist currents within the Polish party.

A number of external factors, both economic and political, made Poland particularly appealing to Western investors as well. For one thing, Poland's large deposits of sulphur, copper and coal - especially valuable after the 1973 energy crisis - put it in a unique situation in East Europe in that it did not have to rely so heavily on more difficult to sell and more cyclically manufactured goods in order to cover its credits. For another, Poland has traditionally been favored economically by the West, due to the strong sympathies among Poles for Western culture and nationalism, which Western democracies were prone to exploit in order to weaken Soviet control over East Europe.

Quasi-Reforms. Gierek also turned to economic reforms as part of his commitment to removing bureaucratic barriers so widely criticized by workers, state officials, and even the party itself. In addition, his expansion program looked to systemic

reform to strengthen incentives for productive use of resources and exports. In 1972 a broad package of systemic changes in the economy was ready, and by 1973 a small part of industry adopted some - but not all - of the recommended changes, with the rest of industry scheduled for conversion to the new economic system during 1974-1975.[6]

This package of reforms was not only very limited but also lacked necessary coherence. The actual modifications were limited in fact to one important organizational change, namely amalgamating enterprises into associations and converting them into 'account units' with greater authority over wages, investment, and production decisions. In theory, such new autonomy required accompanying measures to prevent monopolistic abuses. Either direct supervision from the ministries could have been strengthened, or real competition from abroad introduced. In practice, neither measure was taken by the regime.

Associations (also called 'large economic organizations') in practice provided managers with increased opportunities to exploit the potential for monopolistic practices. Not only were price controls loosened (e.g., by allowing managers freely to set prices for new products), but also wage regulations were modified, making the economy look more like a market-like economic system, but actually introducing more chaos to its operation and weakening incentives for efficiency. This increased power of industrial associations provided an additional momentum to the expansionary drive of the new political leadership of

Gierek as well.

The reform package in agriculture was no more innovative. Initially, more favorable economic policies towards private farms were supplemented by a few other measures (e.g., abolition of compulsory deliveries for meat products and potatoes), but in 1972 the regime returned to the previously discarded collectivization. This time the vehicle for changes was to be a large state-owned farm, very much in line with the earlier concentration of agricultural activities in Bulgaria and elsewhere in East Europe and the Soviet Union. This new faith in gigantic agricultural units was, at the same time, in the spirit of parallel reforms in Polish industry.

The economic rationale behind this move was, as declared by the regime, quickly to modernize agricultural production, which in Poland was dominated by small private farms with little specialization and poor mechanical equipment. While not without chances for success in the long-run, this policy ran the immediate risk of undermining overall agricultural productivity in the short-run by diverting economic resources to a non-private sector whose state farms and cooperatives showed only one half of the productivity achieved by private farms.

1.2 Economic Adjustment of 1976-1979

The new policies of Gierek helped revitalize the economy. With an annual average rate of growth in national product close

to 9.8 percent in 1971-1975 (Table 1), Poland also outperformed by few points all other East European countries (with the possible exception of Romania). This fact by itself, but also the large range of semi-liberalization measures, had made the regime very popular with the people. It also had strengthened the position of Gierek within the party. In addition, Gierek's domestic policies and unprecedented activism on the international area had gained him a good reputation among western leaders, particularly those in Europe.

As it turned out, however, to continue its success beyond 1975 the leadership would have to make some policy adjustments. With the oil-price shocks and prolonged recession on western markets that began to affect Poland around 1975, Gierek had to find a solution to an increasing hard-currency shortage. The adjustment requiring the least effort was allow the economy to continue its boom with the help of western credits. Many economists have argued lately that this is exactly what Gierek decided to do, an evidence of his alleged lack of realism. A look at the post-1975 records proves this view to be far from correct.

Neither the package of economic measures introduced in 1976, named by the regime, 'economic maneuver', nor the following steps can be seen as evidence of Gierek's immobilism. In fact, the regime in Poland seemed to be the first, or - one of the first among the East Europeans to try to revise its original program; this did happen even though other East Europeans had encountered the same kind of internal adversities as Poland had at that time.

In addition, this adjustment by Gierek, as will be shown, was pursued in quite an aggressive manner.

Investment Slowdown Both the rising price of oil and the weak demand on western markets made it more difficult to import capital goods, and the regime had to consider curtailing investment programs. Some scaling down of investment outlays was also needed due to the growing imbalance between investment requirements and domestic construction capabilities. Accordingly, the 1976-1980 plan called for cutting the average annual rate of growth in investment to 8 percent, less than half of that reported in the years before. The actual rate turned out even lower than the planned one, i.e., around 2 percent annually in 1976-1978 and then minus 7.9 percent in 1979. In contrast, other East European countries (with the possible exception of Bulgaria) invested heavily up to 1978 (e.g. an average growth rate of 8 percent was reported in Hungary during 1976-1978).[7]

These cuts, one should add, were accompanied by several systemic measures aimed at reducing the power which mammoth industrial associations, joined by respective ministries, were able to bring to bear on investment choices in the earlier years. The decision to dismantle the 1973 regulations and return to the highly centralized system of the past did result in some reduction of this power. In particular, most of the investment funds previously restrained by the associations had been frozen now, and so-called wild investment (i.e., not accepted in the

central plans) were put under more severe scrutiny.

The question arises here, whether the aforementioned cuts were sufficient. Many economists argue that they were not, since the measures taken allowed only for slowing down the expansion of investment, but left its share in the national product very high (i.e., in 1978 it was one point below the 1976 level but still around 25 percent). This is not a sufficient proof, however, for one could claim that any deeper cuts in investment would probably had caused more harm than good, due to, for instance, the cost of freezing already started projects and putting out of work those factories dependent on material supplies from the ongoing plant constructions.

Wage Price Policy Any reduction for demand for hard currency also required some slowdown in domestic consumption, largely fueled by imports of western grain. While necessary, such restrictions on consumption ran an immediate risk of frustrating the workers, who got used to substantial income gains during the 1971-1975 period. The regime had, therefore, to be careful in selecting the exact way of curbing consumption, with three basic policy options to chose from: higher inflation, lower nominal wage increases, and -- finally -- slowdown in employment growth (including open unemployment). These were not alternatives of course, meaning that the regime could pursue the goal through a combination of these three policies.

The obvious preference of the regime was to try to achieve

as much as possible through its traditional stabilization measure, namely that of curtailing nominal wages. The recentralization of 1977 was meant, among other things, to help the regime to enforce such restrictions. These, however, were strongly resisted by workers. Reportedly, as many as several hundred strikes took place in 1976-1979. In most cases the workers won wage concessions, for the regime continued to prefer 'corporatist' measures to police ones. This willingness to accommodate protesters did undermine the regime's effort to reduce nominal wage increases. The annual rate of growth in nominal wages in 1976-1979 was 7.4 percent, only slightly less than in 1971-1975, when the regime did not try to block wage increases (see Table 1).

Thus the regime had no other choice but to resort to a less favorable option, i.e., price increases. In 1976, Gierek was no longer bound by the earlier promise to keep food prices frozen, so his hope was that open prices rises would not impair his credibility. However, when increases in food prices were announced, in July 1976, strikes broke out in several old industrial centers (e.g., Ursus, Random), forcing Gierek to roll back the new prices. Under these circumstances, the regime resorted to more aggressive hidden price increases. As a result, the cost of living indicator rose in 1976-1979 by 6.0 percent on an annual basis, almost three times the 1971-1975 rate (Table 1).

Despite all these political obstacles, Gierek's policy turned out to be a success, at least from a purely economic

perspective. Through inflation and nominal wage limits, the regime succeeded in bringing the rate of growth of real wages during 1976-1979 to 1.3 percent per year (with a drop of 2.9 percent in 1978), far below the already reported rates permitted in 1971-1975, and in contrast with the rest of East Europe, where the slowdown in real wages came only by 1980. This brought some relief to the heavily disturbed economy (see the results of the econometric study by Charemza[8]), but not enough to allow for substantial cuts in grain imports. Clearly, a further series of restrictions on consumption would still have to come.

Agricultural Difficulties. The reduction of grain imports -- these absorbed almost one fifth of the money borrowed from western banks by the regime through 1976 -- could not have been accomplished by a consumption slowdown only: improvement in the agricultural sector was needed as well. Even with the large import of grain (used mostly for meat production), agriculture performed very poorly, with substantial decline in grain production and meat supplies reported both in 1975 and 1976 (see: Table 1). The poor performance could be largely attributed to the unfavorable policies towards private farming, particularly the difficulties in purchasing imported grain (provided mostly to state and cooperative farms), and the losses of income due to price mismanagement.

Only in 1977, did the regime decide to try to revitalize private farming. Among other things, procedures for land purchase were eased. Soon thereafter, the regime introduced several

measures to prevent further outmigration - mostly of young people - from the countryside (almost 2 million people moved to cities in 1970-1977). In addition the regime increased prices for slaughter animals in 1978, and followed with other price revisions, thus making private farming profitable again. However, acceding to pressures from the 'collective farming' lobby, Gierek continued to allocate most of the productive supplies (including western grain) to the less efficient non-private sectors.

Altogether, the total output of agriculture products grew only at an insignificant rate (in 1977-1979). While animal production increased somewhat, grain output did not change at all. Besides, these increases in animal production cost Poland a further escalation in grain imports: the quantity imported doubled in 1975-1979 (see: Table 2). Moreover, the additional supplies of meat were insufficient to supply the domestic market, so that the regime was forced for the first time to allow large imports of meat for hard currency. These figures show that, contrary to many other areas of the economy, the adjustment in agriculture did not produce any significant improvements. In fact, one could call this attempt a major failure in the otherwise well directed adjustment of 1976-1979.

Energy Conservation. To reduce pressures on foreign currency, the regime had to consider some energy conservation measures as well. First of all, it had to deal with the expanding costs of oil imports, fueled by both the post-1973 price increases and the sudden increase in domestic demand. This was in

Table 2

Trade Balance in Food and Fuels, 1970-1984
(million DZ at current prices)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982[1]	1983[1]	1984[1]
A. Food															
Total	242.1	-366.2	-283.8	-176.2	-834.4	-1330.3	-2090.4	-2800.1	-2647.9	-2865.5	-4772.8	-7163.2	-3080.5	..	..
in which:															
CMEA	-258.6	-723.4	-163.1	-163.9	-176.4	- 128.2	100.3	- 156.0	- 253.2	29.6	- 499.7	-1131.9	- 923.5	..	..
Others	500.7	357.2	419.9	- 12.3	-658.0	-1174.9	-2190.7	-2044.1	-2412.7	-2795.5	-4273.1	-6131.3	-2157.0		
B. Fuels															
Total	811.6	1131.3	1267.9	1202.1	2485.0	2928.4	1962.4	1029.1	402.2	- 302.3	-3229.3	-6101.8	-2733.3	..	..
in which															
CMEA	85.7	199.0	291.5	383.6	412.5	136.9	- 342.9	-1253.1	-2095.5	-3152.5	-5098.6	-7741.8	-7210.1	..	..
Others	725.9	932.3	972.4	818.5	2072.5	2791.3	2305.3	2282.2	2497.7	2349.3	1869.3	1640.0	4476.8	..	..
C. Trade balance-															
Others	-588.7	451.2	-1000.7	-4221.4	-7126.2	-8875.3	-9736.2	-7156.2	-5984.1	-5212.3	-2998.2	84.6	4897.0	..	..
Food & Fuels	1225.6	1289.5	1392.3	806.2	1414.5	1616.4	114.6	218.1	85.0	- 446.2	-2403.8	-4491.3	1684.2	..	..

Note: 1 - estimates

Source: Calculated from Rocznik Statystyczny, GUS (Warszawa: GUS), various years.

a way a bigger problem for Poland than for other Eastern Europeans, since at the time of the first oil-price shocks Poland, in addition to 10 million tons of oil from the Soviet Union, had to buy 2.5 million tons of oil for hard currency, an amount close to the dollar imports by the rest of East Europe (excluding Romania). In addition, energy conservation was needed to slowdown domestic consumption of coal, which had a detrimental impact of the Polish exports of this material - traditionally a major single source of hard currency - to the world market.

Many economists (e.g., Portes[9]) currently studying the Polish crisis argue that the impact of rising oil prices would have been less severe than it was, if the regime of Gierek had not put as many resources into high energy-intensive projects as it did. Even if this is true, one should keep in mind that Poland certainly did not possess an Eastern European monopoly on poor investment choices - in terms of energy requirements - at that time. Thus, while investment in energy-intensive steel production quintupled in Poland between 1970-1975, Romania also doubled its capital outlays in steel over that period; Czechoslovakia followed a similar path, despite a modest overall expansion of its industrial sector. Likewise, all of East Europe put an enormous effort into modern petrochemicals, with Hungary - almost completely dependent on foreign sources of fuels - building more and faster than Poland did.

To save on energy, the regime sharply raised prices paid by enterprises for fuels and electricity in 1975, then followed with

another increase. However, due to the general cost insensitivity of enterprises under bureaucratic planning, these revisions probably did not alter the situation much. More direct measures were taken shortly thereafter, including direct restrictions on supplies to users in industry. In addition, the regime slowed down production in a few fuel-intensive sectors, including petrochemicals, where some projects were simply stopped half-way (although petrochemicals continued to grow at high rates in Hungary).

All these measures helped Poland to slow down imports of fuels. The last increase in quantities of imported oil took place in 1976, whereas most of East Europe continued to buy more for another few years (e.g., Romania increased its imports in quantity terms by more than half and East Germany by one quarter in 1976-1979). However, due to the rising prices for oil from both the world market and the Soviet Union, import payments continued to increase. With only modest expansion of hard coal exports, Poland became unable to cover its bill for oil imports. As a result, in 1979 Poland became a net importer of fuels for the first time in the postwar era, so that further cuts in energy consumption had to be made (see: Table 2).

Foreign Trade. As mentioned, all the measures analyzed here were meant, in particular, to allow for both export promotion and import reduction. These were needed, of course, to stabilize the growing foreign debt. To facilitate its policy of restoring balanced trade, the regime returned to the pre-1973 detailed plan

targets, in their most opaque version. With this new enforcement, exports to western countries grew on average around 4 percent in constant prices over 1976-1979, a rather disappointing figure (for instance, Hungarian exports to the West grew annually by 9 percent in that period). In constant prices, imports from western markets increased for the last time in 1976, and then started to decline at a yearly rate of 6 percent during 1977-1979. None of the East European countries embarked so early on such deep cuts in imports from the West (e.g., Hungarian purchases grew around 12 percent annually in 1976-1978). Even with these import cuts - probably excessive at this point of time (see: Fink[10]) - Poland continued to run a trade deficit with the western economies up to 1979, though of rapidly declining relative size (e.g., the deficit amounted to 40 percent of Polish imports in 1976 but only to 21 percent in 1979). Debt service payments were mounting at the same time, due to rapid accumulation of payments of the principal and interest charges. More credits had to be raised in order to cover the trade deficit and to meet due payments, thus in 1979 Poland's net debt reached 20.7 billion dollars, almost three times the 1975 level (Table 3). This, however, was still comparable to the amounts reported by most other East Europeans (e.g., the Hungarian debt tripled from 2.1 to 7.3 billion dollars in 1976-1979[11]). Some economists argue that the major reason for the poor trade performance was that Poland, due to its bad investment choices, including excessive dispersion of capital means (see: Montias)[12], did not create enough export potential to

Table 3

Polish Trade with Western Countries, 1971-1984
(in billion dollars)

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1. Total exports	2.3	2.6	3.4	5.1	5.7	6.1	6.8	7.4	8.4	10.1	..	..	..	..
2. Total imports	2.0	2.7	4.8	7.2	8.7	8.9	8.6	8.9	10.3	10.8	..	..	..	..
3. Trade balance	0.3	-0.1	-1.4	-2.1	-3.0	-2.8	-1.8	-1.5	-1.9	-0.7	..	..	..	..
4. Net foreign debt	1.2	1.5	2.8	4.8	7.6	11.2	14.3	16.9	20.7	23.5	25.5	25.4	26.4	26.8
5. Debt service	0.4	0.4	0.5	1.0	1.5	2.1	3.1	4.5	6.3	8.4	10.9	..	..	..
6. Debt service/export ratio/in percent	12.4	15.4	14.7	19.5	26.3	34.4	45.6	60.8	75.0	83.2	..	..	..	..

Source: 1) A. Lubowski, Gdzie sie podzialy te miliardy, Zycie Gospodzrcze, No. 18, May 1981.

2) Komunikat GUS, Wiadomosu Statystyczne, No. 2, 1985.

back up its credit-based program. However, by a careful study of trade data one finds that, whatever the manner of investment, Poland was able to replace a number of traditional exports with more sophisticated products (e.g., cars and trucks, consumer electronics, construction machinery). To allow a necessary concentration of investment, some industrial sectors were now designed for export expansion, including a large sector of machine-tool building. With this new export potential, Polish sales of manufactures of western markets grew faster than in most other East European countries, and Poland was paid prices superior to those obtained to the latter (excluding Hungary, see: next chapter).

By far a more important factor was that exports to western countries were in strong 'competition' with the domestic market, i.e., both the powerful associations and the workers. The demand was particularly strong for the products built with the latest imports of western technology, exactly the ones the regime wanted to use for export promotion to the West. This pressure was so intense that an extensive 'black market' for products made under western license had developed, with prices often double those set by state administration. If these domestic pressures were relaxed, the amount of goods available for exports on western markets would have been much above the actual.

Summarizing, the adjustment of 1976-1979 meant a slowdown in the pace of consumption growth and investment cuts, used to rather aggressive, causing the rate of growth of national product

first to decline and then to turn negative in 1979 (Table 1). But at the same time, the regime succeeded in reducing the size of trade deficit with western countries, a necessary step towards the stabilization of its rapidly increasing foreign debt. The regime also reduced the gap between demand and supply on western markets (except for the meat market). While pursuing this adjustment, Gierek had to pay certain political costs in terms of the growing intra-party opposition and some loss of popularity with the workers and other social groups.

1.3 Prolonged Economic Crisis : 1980-

When the regime was completing the 1976-1979 adjustment, the most difficult period was just arriving. This was because the debt service payments were about to reach its peak, due to the maturity of the earlier taken credits. Besides, the economy had to cope with the second wave of oil-price shocks, namely the increase of 1979. To raise money for the debt payments under these circumstances, the regime had to introduce measures sharper than those used so far. Not only that further cuts in the absolute size of investment were unavoidable, but this time the regime had to enforce a temporary freeze on consumption, or even let it drop. Only with this austerity program and supplies of fresh credits, the regime would produce viable solutions to the financial problem.

For this economic package to succeed fully, two political

requirements would have to be met. Firstly, internal political stability was needed to ensure that an austerity program would not provoke workers to walk out - as they had on several occasions in the past - thus undermining the foreign trade effort (through losses in production). Secondly, continued good relations with foreign economic partners, particularly the western creditors, were critical. Much of the credit ease enjoyed by Poland was, as already mentioned, a product of particular political interest by western governments in the country, and this had to be preserved if credits were to arrive in required quantities.

However, when Gierek moved ahead with the austerity plan in the mid 1980's, it became clear that neither of these two political requirements could be met. Domestic disturbances erupted, not just to protest the hardships of austerity, but also to show the workers' total disappointment with the inefficiency and repressive nature of the postwar system. These protests were accompanied by a sharp worsening of political relations with Poland's major foreign partners. As will be shown, these political developments not only undermined the 1980 attempt by Gierek, but also other measures that followed. As a result, instead of going through a few 'lean' years needed to solve the financial problem, Poland ended up in an extended economic crisis and even deeper financial difficulties, which have not abated to date.

Lack of Control. Many economists argue that the downturn in

national product by 2.3 percent in 1979 marked the beginning of an extended period of continuous decline in basic economic indicators. But the truth is that in the first half of 1980 the economy showed a sharp recovery (e.g., a 9 percent rate of growth in industrial output, in constant prices). As it turned out, this strong growth could not be continued because of the damage to food production from widespread spring floods, the worst ever reported in the postwar years. Still, the possibility was that even with the worse second half the economy would end up with a low positive rate of growth in national product for the whole of 1980.

The final result of this recovery depended to a large degree on the regime's ability to curtail real wages, particularly given the expected decline in domestic supplies of food. After an extensive 'demobilization campaign', presenting to the people a gloomy picture of the economy, the regime raised the prices of all basic consumer goods in July 1980. As usual on such occasions, the regime promised financial compensations, particularly for the low-income groups (including pensioners). The move was met, however, with widespread domestic disturbances, which made the whole austerity attempt fail. With the compensations actually won by the workers, the rate of growth of real wages for 1980 was 4 percent, a decisive blow to the ongoing recovery.

More importantly, these strikes gave birth to the free (as opposed to official, party-controlled) trade unions, whose power

greatly reduced the regime's ability to pursue any further austerity measures. When Gierek's successor, Stanislaw Kania, and then his replacement, Wojciech Jaruzelski, tried to restore domestic market balance through a high rate of inflation, with their new representation, workers proved powerful enough to push for wage increases that more than kept pace with the price escalation. Thus, in 1981, real wages grew again, this time by 1.5 percent. Since the cost of living increased by 24.3 percent that year, the workers managed - mostly through strike threats - to gain increases in nominal wages of 25.8 percent, leaving the internal market even more unbalanced (see: Table 4).

This bargaining through strikes also caused serious damage to production, particularly because in the process of pushing for wage compensations, the workers won an important concession from the regime, namely a shorter (i.e., five day) work week. In many sectors of the economy neither strikes nor this shortening of the work-week had any impact on production, but in others the losses in output were significant. The most critical was probably the decline in coal production, a major source of convertible currency. In 1980 coal output dropped by 4 percent, and then by as much as 15 percent in 1981. The estimated loss of hard currency revenues during these two critical years was around 1.8 billion dollars, close to 10-15 percent of what Poland had to pay back to western countries as a service on the debt in that period.

Credit Squeeze. Both the uncontrollable wage pressures and

Table 4

Basic Economic Indicators, 1980-1984
(in percent of previous year)

		1980	1981	1982	1983	1984
1.	National product	-6.0	-12.0	-5.5	4.5	5.0
2.	Industrial product					
	total	-0.2	-11.0	-2.0	..	..
	sales	..	-12.6	-2.0	6.7	5.3
3.	Agricultural product					
	total	- 9.6	4.1	-4.5	3.6	5.7
	crops	-15.2	20.3	-3.3	6.0	7.6
	animals	- 3.3	-12.5	-5.8	1.0	3.6
4.	Investment	-10.5	-25.0	-19.0	4.8	10.0
5.	Investment/national product ratio	17.3	20.0	17.9	..	..
6.	Employment	- 0.1	0.3	-4.0	-0.2	0.5
7.	Labor productivity	- 1.0	-12.2	4.0	8.0	5.9
8.	Nominal wage	12.8	25.8	51.0	25.4	19.6
9.	Cost of living	9.1	24.3	101.5	23.0	16.0
10.	Real wage	4.0	1.5	-25.0	1.8	..
11.	Real wage/ productivity ratio	..	..	..	0.22	..

Source: E. Zaleski, La crise economique polonaise et son impact sur le C.A.C.M. 1984 (mimeo), and Rocznik Statystyczny GUS (Warszawa: GUS), various years.

total chaos in domestic production had a chilling effect on western creditors. The 1979 initial drop in national product, which left coal production unaffected, did not scare them, so that the Polish loan was oversubscribed in that year. In early 1980 credits totaling 1.2 billion dollars were still made available to Poland. This time, however, it was governments not banks that took the lead, a sign that the banks were getting more and more uneasy about the economic condition of Poland. The critical change came in 1981, when western banks started to panic and suddenly withdrew their short-term deposits, and the same move by East European countries followed. Western governments tried to come up with assistance, providing around 1.4 billion dollars. But with the large outflow of money to the banks Poland received only a net of 200 million dollars for the whole year.[13]

This credit squeeze forced the Kania regime to open talks on rescheduling its debts. Talks were concluded, after more than six months, with an agreement that permitted Poland to postpone 2.4 billion dollars in payments due that year. However, at this point Poland needed something more than a quick-fix rescheduling package. No long-run plan for solving financial difficulties was worked out, and no fresh credits were attached. This situation was very much different from the conditions of most other large rescheduling deals, whether for Yugoslavia in 1981[14] or for the heavily indebted countries of Latin America (e.g., Brazil received several billion dollars in fresh money when first rescheduling its huge debt in 1982).[15]

The major reason for these poor arrangements was that all the talks were practically left to western banks, whereas a strong involvement by governments was necessary to put negotiations in a proper perspective. Western governments did not provide this kind of leadership since no clear, unified political strategy towards the Polish crisis had been worked out, largely because they were very uncertain about the exact outcome of ongoing political struggles between the free unions and the party. Alternatively, this kind of guidance could be provided by an international institution such as the World Bank, but Poland was not a member of any such agency at that time. This made the situation of Poland different from that, for instance, of Hungary which has not only been helped by western governments but also assisted by the World Bank since 1982.

In this situation, some assistance from the Soviet Union became an important alternative. The Soviet Union indeed provided some help, but only on a temporary basis. In 1980-1981, the total assistance amounted to 3 to 4 billion dollars, which included 1 billion dollars in hard currency credits and a nonrepayable grant of 500 million dollars. The rest consisted of trade deficits not cleared by Poland, with no direct impact on its ability to service the debt to western countries. East Europe did not provide any substantial help at all. The only important exception was a small emergency shipment of goods by East Germany, while a majority in East Europe put additional pressure on Poland by reducing exports in order to cut their recent trade surpluses

(see more: Fink [16]).

To get a clear picture, however, one should keep in mind that during this critical period the Soviet Union did not provide Poland with additional material resources - to offset the loses in western supplies - but merely kept up current deliveries. The earlier mentioned uncleared deficits came from higher prices for Soviet oil and other raw materials, supplied to Poland in more or less the same quantities as in 1979. In fact, other Eastern European countries were allowed similar trade deficits with the Soviet Union, though their economies were in much better shape and no political turmoil was taking place (Hewett[17]).

Besides, Poland did not benefit at that time from such forms of 'special treatment' as, for instance, the Soviet policy of supplying Bulgaria with excess quantities of oil, reexported by Bulgaria for hard currency. In 1979, Bulgarian sales of Soviet oil amounted to 2.4 million tons, almost 30 percent more than what Poland had to buy for dollars that year, with its severe dollar shortage. Also, while Poland cleared all its trade with the Soviet Union in nonconvertible rubles, Hungary also ran dollar accounts with the Soviet Union, which in 1980 provided it, for instance, with a surplus of about 1 billion dollars, a sum close to the Hungarian trade deficit with western countries in that year (see: Marrese[18]).

Further Decline. With a failing austerity plan and no hope for financial assistance from the West, the regimes of Kania and Jaruzelski spent almost all of 1981 cutting both western imports

and investment outlays. These restrictions were heavier than ever before. After a still modest drop in western imports of 8.2 percent in 1980, 1981 witnessed as much as a 34.6 percent decline (both in constant prices). Sharp squeezes in imports not only forced a drastic reduction in the number of new projects but also a freeze or termination of many ongoing ones. Altogether, investment outlays dropped by 10.5 percent in 1980 and by 25.0 percent in 1981, a figure never experienced before (see: Gomulka[19]).

To minimize the negative impact of both reduced imports and lower investment, the regimes of Kania and Jaruzelski had to revise quickly the planning priorities and act accordingly. This did not happen however, since they put too much energy into political combats with several million members of strong free trade unions. Besides, the lower officials in the state administration, confused by the new configuration of political power, became inclined rather to do nothing than either to follow their orders and upset the workers, or to give in to the pressures by the workers and displease the supervisors (see: comment by Gomulka[20]). Consequently, the cuts were pursued without a clear list of priorities and in an disorderly manner, thus aggravating the shortages.

The two regimes were pressed by the free unions and some political radicals within the party to arrest the chaos by a complex reform in the bureaucratic economic system. But the issue had been highly politicized, similarly to all major economic

issues at the moment. An ambitious program had been designed in mid-1981, mostly along the lines of the highly-praised Hungarian system of 1968. One does not know whether this kind of system could have worked under the then-existing economic conditions, but the feasibility aspect was an obstacle here. One politically crucial question, namely that of who would appoint managers, totally divided the party and the free unions, and this very fact effectively blocked an introduction of the reform program for months.

Thus, the economy slipped from a difficult year of 1980, when a 6 percent drop in the national product was reported, to a fully disastrous 1981, when it declined by 12.0 percent. At this point about 40-50 percent of industrial capacity became idle, with the manufacturing sector being the most heavily underutilized. With these losses in output, total exports declined by 19 percent, and an even sharper drop in exports to western countries occurred, namely minus 22.1 percent in 1981. The western debt increased by another several billion dollars and reached almost 25.5 billion dollars by the end of 1981[21]. All these indicators showed that the economy had clearly collapsed, but the regime still had neither a solid program nor an effective power to launch an anti-crisis package of measures.

Jaruzelski's Program. The regime of Jaruzelski regained some control of the economy only with the imposition of martial law in December 1981, though - one has to stress - economic concerns were not the major reason for that political move. Military rule

was chiefly introduced to crush the free unions, but in so doing, the regime finally gained the power needed, among other things, to impose an austerity program. In February 1982, prices of all consumer goods were raised by 300 to 400 percent, raising the cost of living index some 100.5 percent in that year. Even with the wage compensations that followed, the real wage dropped by 25 percent as a result of the price reform (see: Zaleski[22]).

Moreover, taking advantage of the new regulations, the military regime has managed to keep the level of real wages at this reduced level since. The regime has allowed the nominal wages of several critically important professional groups to rise rapidly, and proceeded with money wage increases for others as well. But at the same time, it has been introducing consecutive price reforms and led the enterprises to revise upward most of their prices. Since 1982 the rate of inflation had always been double-digit, as in 1983 when a 15 percent increase was officially reported, enough to offset the nominal wage rises. Clearly, the regime has decided to, or just has had to, follow the recent pattern of price and wage spiral.

Having arrested the domestic disturbances, Jaruzelski moved to restore order in the planning machinery and end the chaos in production. This was to be achieved, among other things, by the incorporation of the so-called strategic plans into existing decision-making, with as much as 30-40 percent of all materials being distributed that way. Besides, the regime replaced the majority of industrial managers and other state officials with

people perceived as more reliable. Jaruzelski also decided to go ahead with the Hungarian-like economic reform, drawn up before the martial law. Formally, the gigantic associations were abolished and extensive authority passed to the enterprises, with an expectation that they will fully enjoy the new freedoms with the ultimate elimination of the strategic plans (more about this reform in Gomulka[23]).

Within this new planning arrangements, the regime has been able largely to refocus production efforts on a very limited number of targets. In particular, priority has been given to the mining industry as a critical source of hard currency revenues for Poland. Miners have been among the major recipients of wage raises (next to the police and military forces), and the industry has been given the highest priority in material supplies. With these preferences, the hard coal industry started recovering in 1982, when its output was 189 million tons compared to 163 million tons in 1981. By 1984, coal production moved close to the pre-crisis level, i.e., 200 million tons as reported in 1979. The production of sulphur was mostly directed to foreign markets, so that in 1985 the output of this material was back to its 1979 peak.

Paradoxically, the fact that the regime has achieved both a drastic austerity program and the restoration of production, has not encouraged western creditors to reopen financial lines to Poland. Initially, the reaction was to punish the regime for the brutal suppression of the free trade unions with a total ban on

governmental credits and a refusal to negotiate the rescheduling of both private and government-backed debts. Since then, talks on both types of debt have been resumed, first with the banks (i.e., in 1983), and then with the governments (i.e., in 1985). However, Poland has not managed to join the International Monetary Fund nor the World Bank, and no fresh credits of significant size have arrived since.

Moreover, though the Soviet Union instructed Jaruzelski to introduce martial law and crush the free unions, it has not given any significant economic assistance to the regime. No new hard-currency credits have been supplied by the Soviets (or East Europe) to help debt repayments since 1981. The regime also has not received additional supplies of Soviet oil to substitute for dollar deliveries that were cut from 3.5 million tons in 1980 to 500 million tons in 1981-1983. In fact, in 1984 Poland was left with no other alternative and had to return to convertible currency imports, close to 1.5 million tons in that year. This happened even though Poland was promised such substitution by the Soviets. In addition, the pressure on Poland to eliminate its outstanding trade deficits with the Soviet Union (and East Europe) has not been relaxed since.

Illusion of Recovery. The policy of Jaruzelski has produced certain improvements in the economy. Industrial production picked up already by the end of 1982, though for the whole year a minus 2.0 percent rate of change was reported. But in 1983, industrial output grew by 6.7 percent, and then 5.3 percent in 1984 (see:

Table 4). Agricultural production increased as well, with respect to both grain and livestock. As a result, after reaching bottom in 1982, national product has been increasing modestly ever since, i.e., 4 to 5 percent in 1983, and an estimated 5 percent in 1984 (see: Zaleski[24]).

However, one should keep in mind that this recovery still can be considered a disappointment, particularly given the very low level of production reached in 1982. More specifically, with 50 to 60 percent ratio of utilization of existing production capacity, the economy had the potential for much higher increases, with little or no investment required. 20 to 30 percent of capacity is still idle in most industries, and this situation may last for a while. Besides, with growth rates like the ones reported lately, the national product will approach the 1978 level not earlier than 1990. This means that it will take Poland altogether about twelve years to get out of this crisis, by no means a common phenomenon in the whole of industrial history.

Another positive sign has been an upward turn in investment. In 1982, a minus 19 percent change in real investment was reported, whereas in 1983 investment increased by around 12-15 percent, and by 10 percent in 1984. However, most of the problems plaguing investment processes before the onset of martial law have not vanished. The investment cycle (i.e., gestation period) has in fact become longer by almost a year, so that on the average it takes almost 50 months for a project to be completed.

The amount of resources frozen in uncompleted projects increased by another 600 billion zloty during 1983-1984. By the end of 1984 it amounted to the total of 1600 billion zloty, i.e., almost one and a half times the value of new investment spending in that year.

Besides, with such a slow investment upturn and the continuing lack of efficiency, industry is becoming rapidly obsolete in technological terms. Reportedly, machinery in the industry was on average about 60 percent depreciated in 1982. This decapitalization process affects some of the key sectors of industry, including automobile production, where equipment is 17 years old and only an injection of at least 1.5 billion dollars in new machinery can allegedly prevent an irreversible collapse. One should add here that this industry was furnished with advanced machinery under Gierek and became one of the success stories in the export promotion in those years, but most of the market gains have been lost since.

With the low investment outlays Poland is also unable to resume its previously active imports of disembodied western technology. In 1973-1975, some 40 license agreements were signed, but none since 1979 (Poznanski[25]), the reason being that there has been no money to buy license related machinery. As a result of trade disturbances with western economies, Poland has also had to give up many of its cooperation agreements, another potentially important source of technological assistance (e.g., with Singer, Grundig, Thompson).

A positive change has been that Poland has turned its trade deficits with western countries into continuing surpluses. In fact, Poland reported almost balanced trade with the West already in 1980, and the situation remained the same in 1981. In 1982 the economy produced a surplus close to 500 million dollars, rising to 1.5 billion dollars in both 1983 and 1984. However, this was achieved mainly through very low imports combined with a rapid increase in the exports of raw materials and food. Nonetheless, exports to western markets are still below the 1979 level, and sales of manufacturing goods have continuously declined since 1980 (the same trend has been noticed for most of the other East European countries, see: Poznanski[26] and Table 5).

Even with this improvement in the balance of trade with the western countries, Poland has been unable to begin paying back the bulk of its debt. The trade surplus earned so far is only big enough to allow Poland to resume servicing some debt, though payments represent only a fraction of what Poland would have to pay without the rescheduling agreements. According to Vanous[27], in 1984 the Polish balance of payments was probably negative, with about 200 million dollars in payments due not being met. Clearly, Poland has not so far put its foreign debt under firm control, in sharp contrast with other Eastern Europeans (e.g., Hungary reduced its debt to western countries by almost 1 billion dollars in 1982-1984).

Summarizing, the political developments triggered by the mid-1980 price reform have diverted Poland from the track of

Table 5

Indices of Poland's Trade, 1970-1984
(1970=100, in constant prices)

Year	Imports			Exports		
	Total	CMEA	Others[1]	Total	CMEA	Others[1]
1970	100.0	100.0	100.0	100.0	100.0	100.0
1971	106.5	106.9	104.9	113.8	111.3	120.7
1972	122.7	124.0	120.4	138.9	122.8	174.8
1973	136.2	138.9	133.6	170.4	138.7	204.8
1974	153.6	160.7	141.4	194.5	154.4	287.8
1975	166.4	174.5	149.6	204.3	151.0	322.6
1976	173.7	169.3	168.0	223.9	162.5	359.4
1977	187.6	187.2	174.8	223.6	182.1	321.7
1978	198.3	201.2	179.8	227.7	190.7	317.8
1979	211.8	220.6	183.8	225.6	193.9	305.4
1980	202.7	199.4	190.9	219.3	197.0	279.8
1981	161.7	165.3	144.9	175.0	179.7	183.2
1982	176.3	199.7	142.7	147.7	178.8	127.0
1983	192.0	217.9	154.4	152.9	186.0	130.4
1984	209.3	229.9	173.5	166.7	197.0	197.6

Note: 1 - Western countries and non-CMEA developing countries.

Source: E. Zaleski, La crise economique polonaise et son impact sur le C.A.C.M., 1984 (mimeo).

economic adjustment, which in its essence did not differ much from the measures undertaken by other Eastern European countries in order to resolve their payment problems. Both domestic conditions (i.e., readiness of workers to accept austerity measures) and external factors (i.e., accessibility of bank credits) had worsened, so that a very deep reduction in production became unavoidable. The transition to a military regime has not created sufficient conditions for a rapid recovery, as the morale of workers remains low and no relaxation of credit restrictions has occurred. 1.4

Conclusion

Given the high momentum of economic expansion of the early seventies and a number of unfavorable external factors that affected Poland since the middle of the decade, some kind of slowdown (or modest decline) in the growth process in the early eighties was unavoidable. This slowdown was the most effective potential instrument for reducing the foreign debt accumulated by Poland in the seventies, for the alternative policy of accelerating exports (while keeping imports down) was not a real option to the regime of Gierek. The former policy was chosen by the regime already in 1976, and it gave some positive results in the following several years. The collapse of the political system, within which key economic decisions are carried out, completely undermined the adjustment program in 1980-1981.

If it had not been for this adverse political development, Poland probably would have been able to resolve its internal and external (i.e., foreign debt) problems in a fashion similar to that of Hungary or, to take a less successful case, Romania, both of which had been growing rapidly in the early 1970's. The prolonged strikes and the disintegration of decisionmaking bodies in 1980-1981 pushed Poland into an escalating crisis, which has been placed instead under some kind of control only after the late 1981 shift from civilian to military rule. With this change Poland has been able to achieve a minor recovery, which because of political factors has been inferior to the latest improvements reported by Hungary and Romania.

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2. Microeconomic Evidence on the Impact of Western Technology Imports on the Polish Economy

A frequent argument regarding the reasons for the Polish crisis and the size of the debt is that the Gierek regime embarked on an ill-designed strategy favoring 'western technology' imports in the seventies. The scale of this import effort and/or the particular investment choices are often identified as major factors contributing to the escalating trade deficit, rapidly increasing foreign debt and subsequent collapse of the economy in the 1980's. The purpose of the following analysis is to determine whether the inputs of western technology, largely financed through foreign credits, really undermined the growth of Polish economy in the period discussed, and whether the extreme severity of the ongoing crisis can be related to this import strategy.

These questions have already been addressed in Chapter 1, but this chapter examines the microeconomic evidence on the impact that imports of western technology have had on Poland's economy since 1970. We begin with a quantitative analysis of the flows of western technology to Poland, followed by a study of changes in the competitiveness of Polish industry in the world market and of the technological level of this industry in the recent past. Throughout this inquiry an effort is made to develop a comparative perspective, i.e., relate the developments in Poland to those taking place in other Eastern European countries

(very much in line with the approach taken in the previous chapter).

2.1 Imports of Western Technology

To assess the impact of western technology on Poland's economy a background analysis of both the scale and directions (i.e., sectoral allocation) of those imports is necessary. To make such an assessment one has to know first, whether the scale of technology imports in the seventies was such that it could have made a difference in the pace of modernization in Poland. The background analysis is also needed to put Poland into an Eastern European perspective, so that one could determine whether Poland was importing more (and/or making less use of) western technology than other countries in the region.

2.1.1 Disembodied Technology Transfers

License Agreements Poland reopened imports of western technology in 1958, then intensified them around 1965, but the most rapid acceleration took place only in 1971. Prior to that year Poland purchased about 11 licenses annually in 1958-1964, and around 22 licenses during 1965-1970.[1] Between 1971 and 1976, Poland tripled the number of licenses purchased annually to an average of 62 contracts. The peak for the seventies took place in 1973, when 83 contracts were signed (see: Table 1). Total payments for licenses (i.e., royalties) increased from 28 million

dollars in 1972 to 81 million dollars in 1978, or three fold.

The same pattern can be observed in many other Eastern European countries, though the data available are too fragmented to allow a precise comparison.[2] In Hungary, similarly to Poland, the number of license agreements tripled in the seventies (i.e., from 18 in 1970 to around 62 during 1975-77). In Czechoslovakia, imports of licenses significantly increased in the late seventies compared to the first half of the decade (i.e., an average of 36 contracts in 1970-74 agianst 56 agreements signed annually during 1975-79). However, the Czechoslovak figures for the late seventies exceeded only by one fourth those for the last few years of the sixties (i.e., an average of 43 contracts in 1966-69). By contrast, no significant upturn in East German license imports took place in the seventies (see: Table 1).

The intensive imports of disembodied technology by Poland did not last beyond the year 1976, earlier identified as the beginning of Gierek's economic adjustment. This policy, involving a slowdown in imports from western countries, resulted in the reduction of license contracts almost to the pre-1971 level, and payments for all licenses declined as well, though not as drastically as new contracts (see: Table 1). During 1980, when Poland entered into crisis, only 6 agreements were signed (all with western countries). Since that time, i.e., in five years, no contracts or licenses have been agreed upon by Poland, and payments have dropped to an estimated 20-25 million dollars in 1983.[3]

Some other Eastern European countries have also reported a reduction of license imports, but not of the same magnitude. Czechoslovakia, despite its easily manageable foreign debt, has clearly cut down on license imports since 1979. During 1979-81, the cumulative number of licenses in operation dropped from 470 to 403, or by 15 percent. Even more drastic was the decline in license payments, i.e., from 66.8 million dollars in 1978 to 27.5 million dollars in 1981, a 60 percent drop (see: Table 1). In contrast, Hungary seems to continue its extensive involvement with the total number of agreements climbing from 379 in 1979 to 519 in 1983, and license payments in domestic currency showing no signs of decline (see: Gueullette[4]).

Altogether in 1972-80 Poland spend 404 million dollars on license payments, which was not much by the standards of some other Eastern European countries.[5] For instance, Czechoslovak expenditure on licenses during the same period amounted to 456 million dollars. Poland spent 11.8 dollars per capita, whereas Czechoslovak payments for licenses were around 30.8 dollars per capita (based on population data for 1975). While the cumulative number of license agreements in Poland was 349 in 1979, the respective figure for Hungary was 379 and 470 for Czechoslovakia. In per capita terms, the figure for Poland was almost one third of the Hungarian and one-half of the Czechoslovak figures. However, Poland was ahead of East Germany in both absolute and per capita terms (see: Table 1).

Patent Activities One can supplement the incomplete data on

Table 1

Number of agreements and payments for licenses
(in million dollars)
Poland, Hungary, Czechoslovakia, East Germany
1966-1983

	Poland				Hungary				Czechoslovakia				East Germany			
	number		value		number		value		number		value		number		value	
	annual	total	annual	total	annual	total	annual	total	annual	total	annual	total	annual	total	annual	total
1966	23	-	-	-	-	-	-	-	62	-	-	3.91	-	-	-	-
1967	32	-	-	-	-	-	-	-	42	-	-	4.68	-	-	-	-
1968	21	-	-	-	-	-	-	-	71	-	-	28.73	-	-	-	-
1969	24	-	-	-	-	-	-	-	40	-	-	47.42	-	-	-	-
1970	21	142	-	-	18	-	1.5	-	44	-	13.0	46.74	-	-	-	-
1971	42	154	-	-	-	-	6.7	-	32	-	-	40.65	36	-	-	-
1972	57	194	-	28.0	29	168	5.0	-	44	-	23.2	53.14	18	-	8.3	-
1973	83	245	-	30.0	35	-	3.4	-	29	303	2.6	47.81	13	-	1.5	-
1974	67	286	-	36.0	43	-	10.4	-	34	356	6.3	55.16	14	-	4.9	-
1975	67	343	-	39.0	60	-	15.6	-	46	376	6.5	45.31	13	-	4.3	-
1976	55	385	-	50.0	59	-	47.6	-	56	405	15.2	65.75	11	-	8.4	-
1977	28	379	-	81.0	68	-	17.1	-	56	432	20.3	64.98	16	-	5.7	-
1978	30	367	-	72.0	111	-	26.7	-	63	439	12.6	66.76	-	-	-	-
1979	12	344	-	68.0	96	379	6.4	-	57	470	8.5	57.28	-	-	-	-
1980	6	329	-	-	-	442	-	-	58	447	12.4	46.32	-	-	-	-
1981	0	284	-	-	-	-	-	-	42	403	3.7	27.53	-	-	-	-
1982	0	230	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1984	0	181	-	-	-	519	-	-	-	-	-	-	-	-	-	-

Sources: 1. Poland - J. Monkiewicz, Licenge, Warsazawa, 1983, Rocznik Statystyczny (Warszawa: GUS), 1981-1984, various years.
2. Hungary - P. Marer, East-West Technology Transfer. Study of Hungary, (OECD: Paris, 1985). J. Maciejewicz and J. Monkiewicz, Trends in Technology Exports from the Socialist Countries, Yearbook of Eastern European Studies, Band 10, Wien 1982, p. 199.
3. Czechoslovakia - F. Levcik and J. Skolka, East-West Technology Transfer, Study of Czechoslovakia, (OECD, Paris, 1984).
4. East Germany - Zentrales Lizenzburo der DDR, 1980 (mimeo).

licenses with world patent statistics. There is some evidence that the flow of western licenses to Poland as to other Eastern European countries has been accompanied by patent applications from respective countries, and that the scope of license activities is correlated with the magnitude of patenting (see: Poznanski and Glinski[6]). Since these two indicators reflect the flow of disembodied technology, patent data will be looked at to obtain a more specific picture of the pattern of technology imports by Poland and of other Eastern European countries as well. In addition, patent statistics, unlike license data, allow one to separate western flows of technology from the flows of technology among the Eastern Europeans themselves.

In the late sixties, Poland was one of the least active Eastern European countries in terms of attracting western patents. With an average of 350 patents granted in 1967-69, Poland was much behind East Germany - 1245 patents, Czechoslavakia - 737 patents, and Hungary - 513. With the acceleration that took place in the seventies, Poland reduced its distance from the leaders. The cumulative number of patents granted by Poland in 1973-78 amounted to 8 318, still less than in East Germany (12 660 patents), but very close to Czechoslovakia (9 104 patents), and this time ahead of Hungary (5 462 patents). Even during this period of acceleration, the number of western patents per capita was lower in Poland than in the other three countries (but above that reported by Romania).

During the last few years the number of patents granted,

similarly to the number of licenses and royalty payments, generally declined.[7] Again with the exception of Hungary (and Romania for which license data is not available), all Eastern European countries report a decline in the intensity of patenting. The most drastic cut took place in Poland, where the number of patents declined by more than 50 percent from an average of 1456 patents in 1976-79 to 708 in 1982. The respective figures for Czechoslovakia were 1 487 patents and 1 189 patents, (a decline by 20 percent), while in East Germany the number of patents dropped from a 1976-79 average of 1 626 to 948 patents in 1982 (see: Table 2).

2.2.2 Embodied Technology Imports

Engineering Goods Almost simultaneously with the aforementioned acceleration of license agreements in 1971, Poland began to expand rapidly its purchases of western machinery and equipment, a major source of embodied foreign technology. In fact, a large fraction of machinery and equipment imports were needed to implement the then acquired licenses.[8] This acceleration is well reflected in the statistics on imports of machinery and transport equipment (i.e., SITC-7) by Poland from the OECD countries, and even more accurately in the data on purchases of specialized machinery and metal-working machinery (i.e, SITC-7.2 and SITC-7.3). The reason is that the latter represent the active capital unlike some other product categories

Table 2

Patents Granted by Western Europe to Western Countries, 1967-1982

Year	Poland	Bulgaria	Czecho-slovakia	East Germany	Hungary	Romania	Eastern Europe
1967	310	109	893	1311	379	914	3916
1968	318	92	618	≈1200	570	230	3028
1969	423	63	700	1225	591	114	3116
1970	321	266	821	1943	594	63	4008
1971	461	207	856	2543	816	181	5064
1972	673	175	674	2358	1269	454	5603
1973	331	437	1541	2581	1079	488	6457
1974	775	337	1379	2850	991	425	6757
1975	2843	432	1722	2351	951	502	8801
1976	2070	266	1438	1867	911	439	6991
1977	1301	196	1331	1676	825	≈500	5829
1978	998	325	1693	1335	705	628	5684
1979	-	-	-	-	-	-	-
1980	1663	363	1462	1089	795	598	5970
1981	-	-	-	-	-	-	-
1982	708	154	1189	948	877	715	4591
Total 1968-1978	10878	2905	13666	23240	9681	4938	65308
Subtotal 1967-1972	2560	912	4562	10580	4219	1956	24769
Subtotal 1973-1978	8318	1993	9104	12660	5462	2982	40539

Source: Industrial Property Statistics (Geneva: WIPO).

classified as machinery and transport equipment.

Poland increased its imports of specialized and metal-working machinery from the OECD countries in 1970-75 by 860 percent, to be compared with a 865 percent index for the whole of Eastern Europe. Second to Poland was Bulgaria with 603 percent, followed by Hungary with 388 percent, on the bottom was East Germany with a 157 percent index. With this very rapid expansion of imports Poland became the major recipient of OECD machinery of that type. In 1970 Poland accounted for 12.5 percent of all specialized and metal working machinery bought by Eastern Europe and as much as 44.8 percent of the total for 1975 (Czechoslovakia, the leading importer in 1970, with 16.9 percent, accounted for 16.8 percent of 1975 imports).

Beginning in 1976, Poland's imports of specialized and metal-working machines stabilized for a while, and then started to decline in nominal terms in 1979, reaching bottom around 1982 (see: Table 3). This turn was very radical by Eastern European standards. Thus, while the Polish imports at current prices declined by 32 percent between 1976 and 1980, purchases by East Germany increased by 200 percent, in Hungary - 86 percent, and 45 percent in Romania, the last two cases being the most relevant for comparative purposes. Consequently, the share of Poland in total Eastern European imports fell to 26.7 percent in 1980 (close to that of Romania, 24.3 percent).

Even with the slowdown of the late seventies, Poland remained the major importer of western specialized and metal

working machinery (or total machinery and transportation equipment) in 1970-80, in absolute terms (6.1 billion dollars in purchases against 17.3 billion dollars for the whole of Eastern Europe). However, when normalized for the scale difference, the data on imports of specialized and metal working machinery shows that Poland was buying the per capita average for Eastern Europe. Its share in total imports by the region in 1970-80 was 35.5 percent, only slightly higher than its share in the population of Eastern Europe (i.e., 32 percent in 1975).

The normalized values of imports in current prices indicate that Poland invested around 181 dollars per capita in 1970-80 in specialized and metal-working machinery. This was less than Hungary, which spent 204 dollars, and Czechoslovakia, 201 dollars. If one corrects the data analyzed here (Table 3) for the intra-German trade, the East German figure is close to 167 dollars. The Figures for Romania and Bulgaria were 150 dollars and 140 dollars respectively. In per capita terms, Poland was not on the top of the list either in 1970-75 (Czechoslovakia had a lead) nor during 1976-80 (when Hungary was outspending other Eastern Europeans at least by one third).

Selected Machinery The above foreign trade data shows exaggerated trends in imports of embodied technology, since they are expressed in current prices, which increased rapidly throughout the decade of the seventies. To get more accurate figures one can look at statistics of trade in quantity terms.

Table 3

Imports of Machinery and Transport Equipment (Total M), Specialized Machinery (MS), and Metal Working Machinery (MT), from OECD by Eastern Europe, 1970-1983 (million dollars, current prices)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Eastern Europe														
Total M	1155	1365	1858	2501	3152	4216	4448	4801	5591	5608	5564	4531	3597	3363
SM	353	331	578	840	1041	1284	1193	1254	1404	1292	1368	1045	944	-
MT	131	142	234	354	447	595	847	764	989	984	655	496	394	-
SM+MT	784	473	802	1194	1488	1879	2040	2018	2395	2276	2023	1541	1338	-
Poland														
Total M	232	275	561	1060	1497	2062	1952	1834	1857	1598	1805	939	613	601
SM	67	73	200	377	448	554	510	439	470	349	407	159	110	-
MT	31	33	93	159	230	289	320	322	368	259	183	155	117	-
SM+MT	98	106	293	536	678	843	830	761	838	608	580	324	227	-
Bulgaria														
Total M	100	117	110	144	225	491	401	334	393	317	437	659	587	608
SM	28	32	24	48	54	168	155	116	105	89	106	155	155	-
MT	7	15	13	15	31	43	40	37	27	19	38	60	85	-
SM+MT	35	47	37	63	85	211	195	153	132	108	144	215	240	-
Czechoslovakia														
Total M	276	289	304	414	547	668	685	766	910	878	985	761	725	640
SM	108	110	108	139	186	222	207	250	263	257	312	215	223	-
MT	25	24	32	43	53	94	118	91	123	109	109	65	65	-
SM+MT	133	134	140	182	239	316	325	341	386	366	421	280	298	-

Table 3 (Cont'd)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
East Germany														
Total M	153	181	219	180	216	332	368	301	293	720	538	697	511	609
SM	53	48	33	61	72	83	78	69	81	141	139	136	134	-
MT	13	11	14	13	13	21	23	26	28	38	70	85	62	-
SM+MT	66	69	47	74	85	104	101	95	109	179	209	221	196	-
Hungary														
Total M	135	191	230	273	394	461	524	711	978	919	898	943	874	704
SM	34	55	65	85	138	135	150	211	295	237	236	262	261	-
MT	9	11	15	17	23	32	45	88	80	102	76	60	49	-
SM+MT	43	66	80	102	161	167	195	299	375	339	312	322	310	-
Romania														
Total M	259	312	434	542	701	674	518	855	1160	1176	901	532	287	201
SM	63	86	148	130	143	122	93	169	190	219	168	118	61	-
MT	46	48	57	107	97	116	97	200	363	335	179	71	16	-
SM+MT	109	134	205	237	240	238	190	369	553	554	347	189	77	-

Source: Foreign Trade by Commodities (Paris: OECD, 1982) and Foreign Trade, Analytical Tables, (Paris: OECD), 1982, 1983 (microfiche).

Another advantage of using this source is that, in several cases, it allows one to identify the relative importance of western imports in total imports by Eastern Europe (an approach which is complicated to pursue with the data on values of imports due to inaccuracy of exchange rates used by Eastern European statistical sources).

Polish imports of machine-tools from western countries showed a strong upward trend from 1970 to 1975, from 0.5 thousand units to 4.0 thousand units. Total imports increased from 4.8 thousand units to 11.6 thousand in 1970-75, i.e., by half. Consequently, the share of western machine-tools in total shipments increased from 10 percent in 1970 to 35 percent in 1975. Since then, however, imports declined continuously to 0.7 thousand units of western machine-tools in 1983, when the share of machinery in total imports was down to 12 percent (see: Appendix 2.1).

In metallurgy, another priority sector for western imports, the pattern was quite similar. Imports of equipment for this sector from the world increased in value terms from 60 million zloty in 1970 to 983 million zloty in 1976, more than sixteen times. One can estimate the rise in quantity terms at almost ten times. From the peak year of 1976, the imports declined, and were down by more than two-thirds in 1980. As the analysis of the sources of this equipment indicates, most of the additional imports for the metallurgy sector came from the western markets (see: Appendix 2.2).

The inclination of Poland to redirect its imports of technology towards western countries can be compared with those Eastern European countries for which appropriate statistics exist. During the investment period of 1972-77, almost 27 percent of all machine tools imported by Poland came from western countries, whereas the data on quantities purchased by Czechoslovakia show an average 36 percent share for machine tools obtained from western and developing countries together.[9] It is very likely that if imports from developing economies were excluded, the share for Czechoslovakia would be close to that reported by Poland.

To obtain a more comprehensive picture of the propensity of particular Eastern European countries to import technology from western countries, value data have to be used again. Continuing with machine tools, in 1974-77 up to 60 percent of Poland's imports of these goods came from western countries, whereas in Hungary this share was close to 58 percent. This contrasted with the import structure in Czechoslovakia, where an average 35 percent of imports arrived from western markets, and with the 22 percent share reported by East Germany, both during the period of 1975-79 (data for other countries in the region are not available).

In the case of imports for the textile and leather industries, almost 65 percent of the total expediture during 1971-75 was devoted to western equipment. This is to be compared with a 40 percent share in East Germany during the same period.

Almost 75 percent of machinery for the chemical industry was purchased by Poland from western sources in 1973-1976, whereas in Bulgaria, probably one of the least inclined to rely on western markets among all Eastern Europeans, this share was 45 percent. Only an analysis of an extended number of imported goods could provide a sufficient basis for a precise evaluation of the relative import propensity of particular Eastern European countries.

Summarizing, Poland rapidly increased its imports of western technology during the Gierek expansion policy of 1970-75, then followed with a marked slowdown which ended up with sharp reductions in imports in the eighties. The speed of the 1970-75 acceleration of technology imports by Poland exceeded the parallel efforts by other Eastern Europeans, particularly this of the most conservative importers, East Germany and Bulgaria. But in per capita terms Polish imports were of comparable magnitude to many other countries (e.g., Hungary and Czechoslovakia). The post 1975 slowdown in Poland's imports was not an exception either, though none of the other East Europeans allowed its transfers to be cut so severely as in Poland. Still, one could expect the initially more rapid increase in imports by Poland to show up in its subsequent trade performance.

2.2 Impact on Hard-Currency Exports

One of the critical aspects of the ongoing discussion on the

outcome of western technology imports in the seventies is the question of how these purchases affected Poland's ability to trade with western countries. We are looking here for evidence on whether Poland, and other East European countries -- regardless of the degree to which they became involved in technology imports -- have improved their export base for trading with the West lately. Also, we intend to determine whether these countries have been successfully restructuring their export offer to western countries with or without the help of western technology, in other words, whether they have been moving away from low-processed to high-processed goods since 1970.

2.2.1 Changes in Market Shares

A synthetic indicator of the ability of a given country to create export potential is the change in its market shares abroad. If a country increases its portion of foreign markets, this implies relative success in building up its export potential while a decline in market shares shows the opposite. In the specific context of this analysis, the most appropriate indicator is the analysis of trends in Polish and other Eastern European countries' market shares in western imports. This is because western markets were the largest for export production at least by some Eastern Europeans and even where they were not targeted specifically, these particular markets remain critical for sustaining a continuous flow of foreign technology.

The Gierek Period. Analysis of the OECD market reveals that, as far as total exports are concerned, Poland and Romania were the only two Eastern European countries reporting any gain during 1970-1975. Poland's share in OECD imports increased from 0.46 percent to 0.54 percent, (see: Table 4). Romania achieved a four hundredths gain in that period, but for Czechoslovakia, the market share dropped from 0.33 percent to 0.28 percent. In the second half of the seventies Poland began to lose its market share, so that by 1979 it was slightly below the 1970 level. Czechoslovakia and East Germany were moving further away from their 1970 levels in that period of time, whereas in Romania, Bulgaria, and Hungary the shares stabilized.

To provide additional insights, trends on the Western European market are analyzed. An advantage of looking at this market alone is that it represents the major source of hard currency for the Eastern Europeans, while other western market (i.e., Japan, United States, and Canada in particular) are of marginal importance (e.g., the United States accounted for only 8.3 percent of Poland's sales to the OECD in 1980). Therefore, their ability to strengthen competitive positions abroad is more accurately reflected in Western European foreign trade statistics - here the Eurostat sources are used (see: Table 4).

Unlike in the case of the OECD market, the Eastern European share in Western European imports (i.e., by the members of the European Community) declined from 2.43 percent to 2.35 percent during 1970-75 (Appendix 3.1). Note that in this particular data

Table 4

Export Market Shares of Eastern European Countries
in the OECD Market for Manufactured Goods
(in percent)

	1970	1975	1979	1980	1981	1982	1983
1. Total (SITC-0 to 8)							
Eastern Europe	1.54	1.55	1.40	1.30	1.16	1.13	1.10
Poland	0.46	0.54	0.44	0.40	0.27	0.27	-
Bulgaria	0.10	0.07	0.08	0.07	0.06	0.06	-
Czechoslovakia	0.33	0.28	0.24	0.23	0.21	0.21	-
East Germany	0.18	0.17	0.14	0.15	0.16	0.19	-
Hungary	0.23	0.21	0.22	0.20	0.19	0.19	-
Romania	0.24	0.28	0.28	0.25	0.27	0.21	-
2. Chemicals(SITC-5)	1.53	1.51	1.27	1.44	1.50	1.52	1.50
Poland	0.31	0.30	0.22	0.25	0.21	0.15	-
Bulgaria	0.12	0.08	0.07	0.08	0.08	0.10	-
Czechoslovakia	0.26	0.25	0.24	0.30	0.30	0.35	-
East Germany	0.43	0.44	0.29	0.33	0.40	0.42	-
Hungary	0.18	0.23	0.28	0.30	0.30	0.28	-
Romania	0.23	0.21	0.17	0.18	0.21	0.22	-
3. Manufacturing goods (SITC-6)	1.63	1.64	1.78	1.69	1.60	1.56	1.70
Poland	0.39	0.41	0.49	0.54	0.42	0.36	-
Bulgaria	0.09	0.08	0.09	0.07	0.05	0.08	-
Czechoslovakia	0.48	0.46	0.45	0.39	0.39	0.42	-
East Germany	0.21	0.18	0.20	0.18	0.20	0.24	-
Hungary	0.24	0.23	0.25	0.23	0.21	0.22	-
Romania	0.22	0.28	0.30	0.26	0.33	0.24	-
4. Machinery & Transport Equipment (SITC-7)	0.61	0.82	0.77	0.76	0.63	0.53	0.40
Poland	0.10	0.27	0.27	0.25	0.18	0.13	-
Bulgaria	0.02	0.02	0.02	0.03	0.03	0.02	-
Czechoslovakia	0.23	0.21	0.16	0.14	0.12	0.10	-
East Germany	0.16	0.16	0.13	0.13	0.11	0.12	-
Hungary	0.05	0.08	0.11	0.12	0.10	0.10	-
Romania	0.05	0.08	0.08	0.09	0.09	0.06	-
5. Miscellaneous Manufacturers (SITC-8)	1.75	2.52	2.25	2.12	1.88	1.75	1.60
Poland	0.29	0.54	0.48	0.44	0.35	0.28	-
Bulgaria	0.09	0.07	0.07	0.07	0.06	0.06	-
Czechoslovakia	0.44	0.47	0.34	0.34	0.30	0.28	-
East Germany	0.33	0.33	0.27	0.27	0.25	0.24	-
Hungary	0.31	0.48	0.44	0.42	0.38	0.33	-
Romania	0.29	0.63	0.65	0.58	0.54	0.56	-

Source: Foreign Trade by Commodities, (Paris:OEDC), 1982 and Foreign Trade, Analytical Tables, (Paris: OEDC, 1983.

set the intra-German trade, known for its stability, is included (see: Poznanski[10]). The only country to show a gain was Poland (i.e., from 0.56 percent to 0.65 percent, so that without Poland Eastern Europe lost market share in that period, from 1.87 percent to 1.70 percent, (with Bulgaria and Czechoslovakia contributing most to the drop). One may see this exceptional export drive in Poland as an outcome of its rapid increase in technology imports in those years.

Returning to the OECD statistics, one can notice that the two areas in which Poland achieved the most significant gains in 1970-75 were two categories of manufactured goods, machinery and transport equipment (SITC-7), and miscellaneous manufactures (SICT-8). In the first group, Poland reported a gain of 17 hundredths percent (see: Table 4), while in Hungary and Romania the respective gains were 3 hundredths only, and all other Eastern Europeans experienced losses or at best preserved their earlier shares. Again, Poland, Romania, and Hungary were the only countries to show large gains in the Western European market for miscellaneous manufactures (i.e., 25, 34, and 17 hundredths of a percent respectively).

In 1976-79, when Eastern Europe began losing its market share in OECD imports of both machinery and transport equipment and miscellaneous manufactures, Poland continued to be one of the exceptional cases. In Poland, the share for machinery and transport equipment remained stable (i.e., 0.27 percent) in those years, while in many other countries the respective shares

continued to decline (except for Hungary, where some gains were reported). In miscellaneous manufactures Poland lost a fraction of the 1975 share, but not as much as, for instance, Czechoslovakia (see: Table 4). This could be another indication that western imports did help Poland to promote exports to the west.

Recent Trends. The relative successful export promotion by Poland in the seventies stopped around 1980, followed by a sharp decline in Poland's sales to the OECD countries in 1981 and another, though less severe, reduction in 1982 (all in current prices). During this period the absolute nominal value of the OECD trade dropped as well, but not as dramatically as it did in Poland. Specifically, total OECD imports from the world declined by about 11 percent between 1980-82, while the respective rate for Poland in that period was almost minus 40 percent.[11] Even more contrasting trends occurred in the trade of machinery and transport equipment (SITC-7), where the total imports by the OECD declined by 2.5 percent, while shipments from Poland dropped by 47.8 percent.

With such sharp declines in exports, Poland has recently lost whatever it gained on the western market during the successful period of the seventies and incurred additional losses of unprecedented magnitude. The share of Polish sales in total OECD imports dropped from 0.44 percent in 1979 to 27 percent in 1982, a seventeen point difference. On the Western European

market alone, the respective share declined from 0.55 percent in 1979 to 0.36 percent in 1982, by nineteen points (Appendix 3.1). Similarly sharp were declines in the market share for major manufactured goods, such as machinery and transport equipment (fourteen points), miscellaneous manufactures (twenty points) (see: Table 4).

The question arises whether this recent decline in Polish exports to the west, particularly the inability to sell manufactured goods at the level reported prior to the recent economic crisis, is evidence that the Gierek policy of technology imports was from the beginning doomed to fail. More specifically, were the purchases of western technology in any sense excessive and/or ill directed (i.e., sectoral miscallocation), so that this collapse of exports in the last years could be blamed on earlier policy misconceptions, or rather are other economic, and non-economic forces, to be identified as the source of the aforementioned downward trend.

To answer this question, a comparison of the recent trends for all Eastern European countries is appropriate. If the rapid increases in imports of western technology by Poland were responsible, in whole or in part, for the collapse of its exports, one would expect, those of the Eastern Europeans that did not invest as much as Poland in their technology imports to perform better than Poland. The latter should also show performance superior to other aggressive importers of western technology in the seventies, including Hungary. Besides, if

intensive imports were responsible for the Polish collapse, one could expect Hungary also to suffer more severe losses than the more conservative importers (e.g., East Germany).

The OECD statistics reveal that the recent decline in the absolute value of exports to western markets has not been limited to Poland. Between 1980 and 1983, total sales by the region to the OECD countries declined by 21.6 percent. If Poland is excluded, the respective rate turns out to be minus 13.4 percent (see: Table 6). The only country with positive rates of change in absolute exports of all products was East Germany (i.e., increase by 11.5 percent during 1980-83). In Hungary the decline was 11.1 percent, in Czechoslovakia 18.3 percent, Romania 19.8 percent, and in Bulgaria 26.5 percent, the three latter cases much above the negative rate for the total OECD imports in that period.

In the machinery and transport equipment area, Eastern Europe experienced an even more severe decline than in total trade. The sales of these manufactures diminished by 36.6 percent during 1980-83 for all of Eastern Europe, and by 28.7 percent when Poland is eliminated (several times the total decline in imports of machinery and transport equipment by the OECD). Looking at the individual countries, in East Germany the rate was minus 21.3 percent, Czechoslovakia - 27.3 percent, Hungary - 27.8 percent, and the sharpest decline in Bulgaria; namely - minus 58.7 percent (compared with a rapid increase of those exports by newly industrializing countries).[12]

As a result of these reductions in various exports to

western countries, Eastern Europe suffered further losses in its market share in OECD imports during the early eighties. As Table 4 shows, the share of Eastern Europe in those imports declined from 1.30 percent in 1980 to 1.10 percent in 1983[13]. When Poland is excluded the loss is smaller: four hundredths of a percent. In machinery and transport equipment the share for Eastern Europe declined from 0.76 percent in 1980 to 0.40 percent in 1983, and without Poland by twenty four hundredths. With almost no exceptions, market shares declined for all goods and for machinery and transport equipment in all countries of the region (see: Table 4).

This pattern of export changes in Eastern Europe since 1980 seems not to be related to cross-country differences in the intensity of western technology imports in the seventies. Poland did suffer the most severe losses in exports, even though its imports of western technology were comparable in size to those of some other Eastern Europeans, such as Hungary. Romania was another large-scale importer of technology, but its latest performance is considerably worse than Hungary's, the only country that ended up in 1982 with a much higher share of the OECD market for machinery and transport equipment than in 1970 (such was also the case with miscellaneous manufactures, though here Romania reported large gain over that period as well).

Even more confusion results if one compares the modest importers of technology with the former group of countries. For instance, Bulgaria, importing limited supplies of technology,

went through the most severe cuts in total exports, except for Poland. However, Bulgaria's losses in exports of machinery and transport equipment were much more drastic than those of deeply troubled Poland. One of the most successful of all Eastern European countries has been another modest importer, East Germany, the only country that managed to increase slightly its share in the total OECD imports by 1982 above the 1970 level. These, slight gains were achieved, however, mostly due to the expansion in non-manufactured goods; for the chemicals, machinery and transport equipment, and miscellaneous manufactures went down below their 1970 shares.

The aforementioned analysis of market shares during 1970-1979 suggests that the imports of technology under Gierek's regime helped Poland to outpace the modest importers among the Eastern Europeans. This trend was terminated with the coming of the economic crisis in 1980, but other Eastern Europeans, regardless of their earlier technology imports policy, have experienced similar change in exports. So, it is likely that the reasons for this collapse are of a more fundamental nature, probably a region-wide structural crisis (as originally defined in an illustrative article by Marer[14]), and that some additional negative forces have made Poland less prepared to cope with this crisis.

The large-scale imports of western technology most likely had a positive rather than a negative impact on the ability of the aggressive borrowers of technology to cope with the latest

economic disturbances. The evidence to support this observation is the generally superior performance of Hungary,[15] particularly in exports of manufactures. One could argue that, if not disturbed by the political tensions, Poland would probably have shown performance similar to that of Hungary. So also would Romania, if not for its refusal to accept financial help from international banks (conditioned on certain economic measures and improvements in statistics) and for the unnecessarily severe deflationary policy selected by its regime (see: Tyson[16]).

2.2.2 Efficiency of Exports

As has been shown by Saunders[17], those exporters who expand their market shares abroad usually belong to the most advanced in technology as well as marketing abilities. For this reason one might expect the picture derived for Eastern European export performance from their market shares to correspond with what one can learn from other indicators of competitive strength and efficiency of exports. However, the general observation by Saunders need not apply to Eastern Europe, or to particular countries in the region, for there is no specific empirical evidence to support this statement for the region (except for some preliminary quantitative work[18]).

Role of Manufactures One of the indicators of trade efficiency is the share of manufactured goods, generally with

higher value added, in total exports from a given country. Of all manufacturing, the most technologically complex and those offering the highest value-added are generally products classified as machinery and transport equipment. For that reason the share of the latter in total exports of a given country can be seen as a particularly useful indicator of its ability to conduct profitable trade; and, in fact, most of the Eastern European planners customarily use this measure to evaluate trade performance and to set objectives for their industries. In addition, this particular product group received the majority of western technology, so that one could have expected any impact of those transfers to stand out particularly.

In 1970, machinery and transport equipment represented 5.8 percent of Poland's exports to the OECD, the second lowest share among Eastern Europeans. The lowest share was that of Romania - 5.4 percent, while two other countries showed only slightly higher shares, namely Hungary - 6.3 percent, and Bulgaria - 7.1 percent. All these economies were at this point much behind East Germany and Czechoslovakia, by then considered to be the most technologically advanced and trade-oriented economies of Eastern Europe. In 1970, East Germany reported 22.7 percent share of machinery and transport equipment, while Czechoslovakia reported 18.7 percent, high even by the standards of western industrial economies (see: Table 5).

By 1975, when one could have expected the first results of increased technology imports to show, Poland's share of machinery

and transport equipment in total sales was already 11.5 percent, twice the initial level. Some gains were also achieved by other less machinery and transport oriented East European countries, but in all of these cases the respective shares were much below that of Poland (see: Table 5). This helped Poland to move closer to East Germany and Czechoslovakia, particularly since the latter experienced a reduction in their shares during 1970-1975 (i.e., to 17.4 percent and 12.19 percent respectively).

In 1979, the share for Poland showed a further gain, to 14.2 percent. With this share Poland, clearly showed the most impressive, improvement in the commodity structure of exports to western countries among all Eastern Europeans (i.e., the 1979 share was two-and-a-half times higher than that of 1970).[19] Next to Poland was another aggressive importer of western technology, Hungary, where the 1979 share amounted to 12.1 percent (i.e., twice as high as the initial share). However, with comparable import acceleration, Romania increased its share only to 6.7 percent in 1979, one fourth above the 1970 level; a puzzling deviation from the trends showed by the former two (see: Table 5).

The positive impact of large-scale technology imports, and of other not here identified factors, on promotion of machinery and transportation equipment exports should be clear, when the record of the aggressive importers is compared with that of the modest borrowers of technology, Bulgaria and East Germany. Comparison with Czechoslovakia is also instructive, though a

Table 5

Total Exports, Exports of Machinery and Transport Equipment (SITC-7) and Their Share in the Total from Eastern Europe to the OECD, 1970-1983
(million dollars in current prices)

	1970			1975			1979			1980			1981			1982			1983		
	Total	S-7	%	Total	S-7	%	Total	S-7	%	Total	S-7	%	Total	S-7	%	Total	S-7	%	Total	S-7	%
Poland	1061	62	5.8	3174	367	11.5	5057	718	14.2	5471	765	13.9	3607	537	14.9	3316	399	12.0	3267	362	11.0
Bulgaria	240	17	7.1	392	36	9.2	915	75	8.2	993	92	9.2	850	96	11.3	805	58	7.2	730	38	5.2
Czechoslovakia	723	135	18.7	1642	287	17.4	2757	410	14.8	326	440	13.6	2729	362	13.2	2677	315	11.7	2627	320	12.2
East Germany	410	93	22.7	1039	228	21.9	1641	352	21.4	2102	411	19.5	2190	348	15.9	2385	370	15.5	2429	321	13.2
Hungary	536	34	6.3	1250	116	9.2	2547	308	12.1	2821	359	12.7	2503	325	12.9	2304	297	12.9	2340	259	11.0
Romania	554	30	5.4	1692	123	7.2	3267	218	6.7	3504	271	7.7	3592	267	7.4	2618	194	7.4	2810	182	6.5
Eastern Europe Total	3524	371	10.5	9189	1157	12.6	16184	2081	12.8	18106	2338	12.9	15471	1935	12.5	14105	1633	11.6	14203	1482	10.4

Source: Calculated from Foreign Trade by Commodities (Paris: OECD).

precise interpretation of that particular case is complicated by an unclear picture of the relative involvement of the Czech economy in western technology imports. Additional analysis is needed to determine properly the exact ranking of Czechoslovakia as an importer of western technology (for more information, see: Levcik and Skolka[20]).

This kind of comparison reveals that the only modest importer that did experience some gains in 1970-79 was Bulgaria. Its share increased from 7.1 percent to 8.2 percent, or by one sixth, still less than Romania. In East Germany the share of machinery and transport equipment modestly declined, while in Czechoslovakia the loss was very substantial. The respective share for the latter dropped from 18.7 percent in 1970 to 14.8 percent in 1979, i.e., by one fifth. Thus, in all three cases the performance was inferior to that of the aggressive importers of western technology, suggesting a favorable impact of the latter factor on export efficiency.

An analysis of the figures for the early eighties should be of some help as well. Specifically, it might provide some insight into the comparative ability of the aggressive and modest importers of technology to cope with the adversities encountered by all Eastern Europeans in those years. As the data in Table 5 reveal, large-scale imports have been of some help here, but only for those which have managed to obtain some external assistance, Hungary being the case in point. Hungary was not only able to keep its losses in the share of machinery and transport equipment

to a minimum in 1980-83, but it also was the only Eastern European country to show at the same time a substantially higher share of these manufactures in 1983 than in 1970 (i.e., 12.1 percent against 6.3 percent).

Interestingly, the two countries that also reported higher shares of machinery and transport equipment in total exports to the OECD in 1983 than in 1970, were the remaining large-scale importers of technology, Poland and Romania (see: Table 5). In contast, all modest importers as well as Czechoslovakia went through a period of declining shares in that period, and in all three the share for 1983 was below that of 1970. In Bulgaria, the share dropped from 6.7 percent to 5.4 percent, one fifth, but in Czechoslovakia the respective share shrank by one third (i.e., from 18.7 percent to 12.2 percent), and in East Germany almost by half (i.e., from 22.7 percent to 13.2 percent). These contrasts reinforce an impression that large-scale imports of western technology have been helpful in selling high-processed goods.

Since Eastern Europe did not import western technology just for its machinery and transport equipment industry, it would be premature to draw any conclusion before determining how the shares for other priority goods have changed. Certainly, one has to look at chemicals as well, for this group of manufactures was another priority recipient of western technology (see: Poznanski[21]). Since it might have happened that particular Eastern Europeans were expanding their exports of chemicals at a different rate, this could have some impact on the earlier

reported figures, and for that reason, on the conclusions presented as well.

Analysis of trade data on chemicals and machinery and transport equipment combined (Appendix 4.1) indicates that among the most successful Eastern Europeans during 1970-79 were again Hungary (i.e., increase from 11.5 percent to 21.3 percent), and Poland (10.5 percent against 17.9 percent). Romania, another likely aggressive importer of technology, did not show any progress however. But the modest importers did not show any progress either. In Bulgaria, the share increased only temporarily, while both Czechoslovakia and East Germany experienced declining shares for these two manufacturing groups (e.g., a decline in the latter from 38.8 percent in 1970 to 36.2 percent in 1979, in both cases the highest share for Eastern Europe). Thus, the inclusion of chemicals does not change the earlier ranking of the countries in question.

Export Unit-Values A useful way of determining how efficient given exports are is to measure unit values, i.e., prices per kilogram (or unit) sold abroad. This indicator has several shortcomings, summarized by Amann and Slama, for example. Whatever these shortcomings are, the indicator is widely used for analytical purposes by economists studying international trade and technological gaps. Not only is this measure relatively handy, but also, regardless of some shortcomings, it seems to give, by and large, the same picture as other indicators of trade efficiency (see: Poznanski[22]).

The figures on unit values for machinery and transport equipment sold by Eastern Europe (and selected western countries) to the EC (see: Table 6), show that Poland obtained the lowest prices per kilogram in the region by 1970. With 0.92 dollar per kilogram, the Polish unit-value represented only about 50 percent of that reported by Hungary (1.80 dollars), and almost 25 percent less than that of East Germany (1.20 dollars), and 20 percent below the Czechoslovak level (1.15 dollars). Indeed, Poland's unit value was close to that of Bulgaria and Romania, at that time considered to be among the least technologically advanced in the region.

Since 1970 Poland, made remarkable progress in improving the efficiency of its trade, so that by 1978 it was paid 2.99 dolalrs per kilogram of its goods, only second to Hungary (3.43 dollars). At this point, Polish prices per kilogram were much ahead of all the modest importers of technology. Poland's unit value for machinery and transport equipment was then almost one third above the East German (i.e., 2.17 dollars), and Bulgarian (2.11 dollars) levels. Even in 1982, when Poland was at the bottom, its value-added, although lower than in 1979, was still comparable to that of many Eastern Europeans (for reasons difficult to explain, Bulgaria and East Germany were leaders at that point).

Polish performance in 1970-78 also looks favorable when its unit values are compared to those of the all exporters to the EC combined (see: Table 6). In 1970, Polish units value represented 36 percent of world unit-values, but in 1978 the respective

figure was 58 percent. Hungary showed some decline in relative unit-values, but still its figure for 1978 was closer to the world level than that of any other Eastern European. Romania showed some improvement, but neither Bulgaria nor East Germany reduced their gap relative to the world level in that period of time, thus providing further evidence in support of the thesis advanced here.

2.2.3 Western Technology and Trade Directions

Among the arguments made by economists studying the Polish case is that the economy has failed to direct sufficient supplies of western technology-based products to the West (see: Fallenbuchl[23]). In other words, the argumentis put forward that, either because of the particular selection of technologies, or due to restrictions agreed upon in the process of license negotiating, or for other reasons, the new production capacities have not made Polish output more suitable to the needs of western markets. Thus, Poland was forced, it is claimed, to sell excessive quantities of new products to the region (including the Soviet Union), which made the repayment of the "technology bill" problematic.

Licensed Products One of the pieces of quantitative evidence used by those who claim that Poland failed to provide foundations for an extended period of import-led technological modernization, is the data on changes in the relative magnitude of license-based

Table 6

Export Unit - Values of Machine and Transport Equipment (SITC-7) Sold in Common Market 1970-1982 (dollars per kilogram)

	1970	1974	1978	1980	1982
World	2.51	4.04	5.12	7.91	6.38
United States	8.65	11.03	15.17	20.40	22.96
Japan	3.68	4.99	6.49	7.17	7.07
Western Europe in which:					
Austria	1.96	4.14	7.22	10.91	6.85
Belgium	1.94	3.24	5.25	6.52	5.32
Great Britain	2.31	3.49	5.73	9.60	9.63
Italy	1.96	3.10	4.52	6.46	4.78
Netherlands	2.68	4.34	5.18	6.02	5.48
West Germany	2.24	3.71	5.97	7.77	5.32
Sweden	2.77	3.98	7.90	8.44	6.70
Switzerland	4.94	8.96	14.51	16.60	11.80
Eastern Europe in which:					
Poland	0.92	1.09	2.99	2.79	2.40
Bulgaria	1.00	1.52	2.11	2.68	3.53
Czechoslovakia	1.15	1.61	2.29	2.79	2.01
East Germany	1.20	1.77	2.17	2.68	3.07
Hungary	1.81	2.08	3.43	4.89	2.96
Romania	1.00	1.43	2.58	3.58	2.76
Soviet Union	1.09	1.16	1.78	2.35	1.58

Source: Calculated from Foreign Trade by Commodities (Paris: OECD), various years.

domestic output, scale of exports of those products, and its destination. This evidence has been presented on many occasions by several Polish economists (see: Monkiewicz[24]), and quoted in economic professional journals (e.g., Lubowski[25]). It was also echoed by some western experts (Nuti[26], Fallenbuch[27]). Some of these arguments are presented below.

An analysis of Polish statistics on licensed production and related trade seems to leave no doubts that the aforementioned claim is correct. As Table 7 shows, the share of license-based production in the total output of industry in Poland increased signficantly in the seventies. In 1970, the respective share was 2.1 percent, but in 1980 it reached 5 percent, one of the highest in Eastern Europe. However, at the same time the share of license-based goods in total exports by Poland did not change much; in 1970 the share was 5.3 percent and it remained the same in 1980. So, one could conclude that the large-scale inflow of western licenses did not help Poland to open the economy to western trade to the degree required by the nature of its modernization strategy.

The data on license-related trade also reveals that, while most of the technological contracts were signed with western countries (i.e., about 90 percent), a majority of the resulting products were sold by Poland to non-western markets in 1970-1980. As Fallenbuch1[28] shows in his comprehensive study of western technology transfers to Poland, at no point in time was Poland was selling more than 45 percent of its license-based exports to

Table 7

License Agreements, Production Licenses and Export from Licenses, Poland, 1970-1983

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1. License purchased in which:	142	154	194	245	286	343	385	379	367	344	329	284	230	181
Applied	112	106	114	141	182	216	238	257	270	268	260	226	185	148
2. License - based production (in billion Zloty)	25	26	28	43	63	87	106	126	134	146	158	96	155	140
as percent of total population	2.1	1.9	2.0	2.7	3.4	4.2	4.4	4.7	4.6	4.8	5.0	3.3	2.3	1.7
3. Exports of licensed products (in billion Dewiza Zloty)	0.7	0.7	0.8	1.0	1.4	1.6	1.7	2.2	2.4	2.4	2.7	1.5	1.3	1.3
as percent of total exports	5.3	4.4	4.2	5.1	5.3	4.6	4.6	5.5	5.3	4.8	5.3	3.5	2.8	2.5
4. Expenditure on (in million Zloty)	--	--	--	1080	1700	2368	3043	3438	2409	2862	2269	1203	666	506
in which: royalties	--	--	--	126	135	174	271	244	203	99	121	59	52	40
related imports of parts and materials	--	--	--	471	758	1147	1246	1292	1057	1283	1235	679	421	324

western countries. According to Monkiewicz[29], in 1980 the total revenues from all license-based exports exceeded their total costs (including royalties), but if exports to western markets are compared with the costs in hard-currency, then the latter exceeded the former by 10 percent in that year (and 40 percent in 1980); further evidence of this bias against sales to western markets.

However, the data on license-related production and trade are highly aggregated, so they may hide some important facts. If one does not know the exact composition of Polish exports of licensed goods in the year 1970, and the changes in the export offer that have more than certainly followed, one cannot make a definite judgement. Besides, one cannot rule out that the discrepancy between the share of licensed-goods in domestic output and in exports resulted, at least partly, from absorption by consumers and investors, something which could have been altered under a successful deflationary program. Certainly other kinds of evidence on the impact of licenses on trade direction are needed.

Market Reorientation

The approach selected here is to determine the trends in exports of particular goods to western and non-western markets since 1970. Twenty three products have been chosen, and the

shares of western and Eastern European (including the Soviet Union and three non-Euroepan centrally planned economies) calculated (see: Table 8). Among the products sampled are many items for which substantial amounts of western technology were imported from the West as well as a number that did not enjoy import priority during the seventies. This selection has been made on purpose, namely to permit correlating trends in export orientation with inputs of western technology.

Of all the products in the sample which have been identified as major recipients of western technology (i.e., in quantities critical for modernization of a particular product line), eight have been found to experience a dramatic shifting from Eastern European and other non-western markets to the West (see: Table 8). These products were: washing machines, refrigerators, sewing machines, passenger cars, (e.g., an increase in the share of western markets in total sales from 11.3 percent in 1970 to 85.6 in 1983) ships, television sets, tape recorders and nitrogen fertilizers (relevant data on the sources of imported technology are presented in Appendix 1.1).

In contrast, among those products for which no massive imports of western technology were designated, or only in the late seventies so that their impact could not be perceived, again eight products have been identified for which Eastern European markets and the developing countries have remained a major sales area throughout the 1970-83 period (see: Table 8). These goods are: household ovens (e.g., in 1970, 88 percent of these products

Table 8

Share of Western (W) and Eastern (E)[1] Markets of Polish Exports of Selected Manufacturing Goods
(in percent)

Item		1970	1975	1979	1980	1983
1. Household ovens (units)	W	7.0	0.0	1.7	0.0	1.3
	E	88.0	89.4	97.1	98.8	94.1
2. Washing machines (units)	W	0.0	0.0	0.0	57.9	15.2
	E	57.0	0.0	0.0	0.0	57.7
3. Vacuum cleaners (units)	W	80.0	65.4	70.7	81.7	91.7
	E	15.9	26.1	19.6	13.6	7.0
4. Refrigerators (units)	W	8.2	44.9	69.2	81.4	96.6
	E	90.0	54.2	24.6	14.3	2.1
5. Sewing machines (units)	W	10.9	56.0	68.4	50.8	28.7
	E	87.3	27.0	30.6	40.9	51.2
6. Combustion Engines (units)	W	0.2	4.2	0.5	0.2	0.6
	E	49.9	38.3	34.9	34.5	73.1
7. Machine-tools for metal (units)	W	24.7	33.6	62.5	56.3	15.5
	E	46.1	43.9	26.4	28.3	70.5
8. Other machines for working metal (units)	W	0.9	3.6	2.4	0.2	0.0
	E	66.7	32.8	51.3	77.5	94.8
9. Excavators (units)	W	0.0	0.5	6.6	0.0	0.0
	E	89.4	90.0	92.1	91.9	29.6
10. Movers (units)	W	0.0	0.0	6.6	0.0	24.5
	E	86.5	0.0	17.3	38.5	31.9
11. Pumps for fuels (units)	W	28.9	20.5	23.0	0.0	0.0
	E	29.9	52.6	38.7	50.4	68.6

Item		1970	1975	1979	1980	1985
12. Passenger cars (units)	W	11.3	30.8	70.8	83.5	85.6
	E	81.9	47.6	24.2	11.9	12.2
13. Buses (units)	W	0.0	0.0	0.0	0.0	0.0
	E	97.4	87.3	99.5	94.5	83.1
14. Trucks (units)	W	0.0	0.0	6.3	0.0	0.0
	E	98.4	87.7	85.6	78.8	98.9
15. Tractors (units)	W	5.6	15.5	31.9	59.1	30.5
	E	5.8	7.8	0.0	0.0	0.0
16. Bicycles (units)	W	39.5	71.5	87.4	81.0	72.7
	E	27.2	4.1	7.0	7.3	28.4
17. Ships (DWT)	W	0.0	28.3	13.5	63.4	48.0
	E	59.3	57.9	35.9	15.8	4.0
18. Television sets (units)	W	0.2	54.0	49.7	25.3	96.8
	E	93.4	0.0	0.0	19.4	2.9
19. Tape recorders (units)	W	0.0	36.4	55.3	0.0	45.1
	E	89.5	61.4	43.9	88.0	53.2
20. Nitrogen fertilizers (tons)	W	13.4	18.5	57.2	54.6	100.0
	E	23.1	11.0	5.4	2.5	0.0
21. Polychloride vinyle (tons)	W	50.0	0.0	72.4	0.0	0.0
	E	39.2	0.0	0.0	98.6	100.0
22. Synthetic fibers (tons)	W	20.8	36.7	5.2	6.8	7.3
	E	22.5	40.3	82.8	84.0	74.5
23. Paint and lacquers (tons)	W	8.5	4.9	5.5	3.2	2.1
	E	82.6	89.6	81.6	82.2	92.3

Note: 1 - Eastern countries include: Eastern Europe, the Soviet Union, Cuba, North Vietnam (later Vietnam), Albania.

Source: Rocznik Statystyeczny, GUS, (Warszawa: GUS), various years.

were sold to Eastern Europe and the Soviet Union, and 94.1 percent in 1983), combustion piston engines (other than foreign cars), machine-tools for metals, other metalworking machinery, pumps for liquids, buses, trucks, and tractors.

If one ignores the remaining cases (ambiguous in terms of the significance of western technology imports, such as bicycles and vacuum cleaners, both highly western-oriented), one can view the above data as some evidence that, despite what the above-mentioned license statistics suggest, imports were probably very helpful in providing Poland with new models of particular products that had better sales chances in western countries. However, this redirection of newly introduced, license-based goods could have reflected, to a degree, policy choices made by the Polish Planners as well.

Summarizing, the survey of several microeconomic indicators shows that, by and large, Poland benefited much from its intensive imports of western technology in the seventies. For most of the decade, Poland outperformed other East Europeans in terms of market gains in western markets and modernization of its export offer (e.g., through expansion of the fraction of machinery and transport equipment in total sales). Hungary and Romania did better than Bulgaria, East Germany, or Czechoslovakia, the least successful of all. Poland's poor performance in the early eighties fits the overall pattern for Eastern Europe, namely substantial market losses in the West, particularly in western imports of machinery and transport

equipment.

2.3 Conclusion

Two Eastern European countries can be identified as the most oriented towards buying western technology in the seventies, namely Hungary and Poland (Romania, and Czechoslovakia seem to belong to this group as well, though there are some contradictory pieces of evidence). The least involved were Bulgaria and East Germany. The analysis of export indicators, i.e., market shares, product composition, and unit-values, shows that all the aggressive borrowers of western technology were outperforming the conservative importers throughout the seventies. Even during the post 1980 economic disturbance in the region, Hungary has been more successful as an exporter on western markets than the conservatives. This can be considered evidence of a positive relationship between the scale of western technology imports and export performance in East Europe, a relationship that applies also to Poland.

When advancing this kind of conclusion, one has to be aware of many limitations of the above reasoning. The data discussed reflect not only foreign technology imports, but many other factors as well. Among them, in particular, are the foreign trade strategies of the countries in question (i.e., their interest in expanding trade relations with western countries as opposed to their involvement with the Soviet Union or other regional economies). Besides, the above analysis has not dealt with the

impact of western technology on the overall import propensity, a critical factor in determining the balance-of-trade effect of technology purchases. Thus, a further analysis, combined with the reconstruction of highly fragmented data sources will be necessary to shed additional light on the issues discussed here.

Footnotes to Chapter Two

1. J. Monkiewicz, Licencje, Warszawa 1985, pp. 30-31.

2. K. Poznanski, Patterns of Technology Imports: Interregional Comparison, World Development, (forthcoming).

3. Estimate based on the trend in domestic currency payments for 1980-1983 as reported in table.

4. From: A. Gueullette, Recent Slowdown in technology imports by Eastern Europe: The case of Hungary, paper for the workshop Technological Trends in the Communist World, Hoover Institution June 20-21, 1985.

5. Another source gives the total payments for 1970-1980 around 600 million dollars, see: J. Monkiewicz, Op. cit.

6. K. Poznanski and P. Glinski, A Comparison of the Competitiveness of Great Britain and West Germany: The Case of Exports to Poland, 1980 (mimeo).

7. This downtrend partly resulted from the overall decline in the world patent activities during the recent (see: Science Indicators Update, Washington: NSF, 1985).

8. It is estimated that in 1974 as many as 46 percent of Western licenses were bought as a part of larger deals on complete industrial plants with foreign partners. In 1978, the respective share was even higher, namely 54 percent (from: J. Monkiewicz, Licenge, Warszawa 1983, p. 64).

9. Calculated from: Statistical Yearbooks, 1972-1980 (tables on imports of major products).

10. K. Poznanski, Impact of Western Technology on Importing Countries, paper prepared for the workshop on Techological Trends in the Communist World, Hoover Institute, Stanford, June 20-21, 1985 (mimeo).

11. Calculated from: Foreign Trade by Commodities, (Paris: OECD, 1982).

12. K. Poznanski, Competition Between Eastern Europe and Developing Countries in the Western Market for Manufactured Goods, in: Eastern European Economies: Slowdown in the 1980's, Vol. II, Foreign Trade and International Finance, Joint Economic Committee, U.S. Congress, Washington, 1985.

13. Assuming that the 1982 share of the OECD market by Poland remained unchanged in 1983 is consistent with trends on the Western European market, (see: Appendix 3.1).

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21. See: K. Poznanski, Problemy Innowacji w pizemysle wegierskim, op. cit., p. 114.

22. K. Poznanski, Technological Levels and World Trade: A Global View, 1983 (mimeo).

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26. D. Nuti, The Polish Crisis. Economic Factors and Constraints, in: The Socialist Register, 1981 (London: Merlin Press, 1981).

27. Z. Fallenbuchl, East-West Technology Transfer. Case of Poland, Op. cit.

28. Z. Fallenbuchl, Ibid.

29. J. Monkiewicz, Ibid., p. 110.

3. The Impact of Western Technology on Industrial Output

This chapter analyzes the impact of the importation of western technology on the level of productivity in the industry as a whole as well as in each of the nine major industrial sectors. In order to derive relatively reliable estimates, we use the entire 1960-83 period as the base for our analysis. Special emphasis is however given to the level of production during 1972-1977 and thereafter, in order to determine whether or not the import strategy behind the "economic maneuvre" was effective.

3.1 Description of the Variables

The measure of western technology used in the analysis is the value of machinery, equipment and completed plants imported from the west. Machinery and equipment is the far larger component of the two. At the beginning of the period (1960), it represented around 27% of all imports while plants represented only 2% of all imports. Whereas the fraction of imports devoted to machinery and equipment grew substantially through the 1960s (to about 36% at the end of the decade) the proportion allocated to plants remained fairly constant up to the 1972-76 period. At that time, each component's proportion of total imports grew rapidly, rising to 41% for machines and equipment and 5% for plants. In the five years that followed, both types of imports of all western technology dropped dramatically.

Whereas the majority of imported machines and equipment were bought from the socialist countries during the 1972-1977 period except in 1975 when non-socialist imports represented 52% of total), CMEA countries only contributed about 9% of the total value of imported completed plants. Therefore, almost all of the plants and less than half of the value of machines and equipment were imported from the west.

With respect to the distribution of imports of western technology across

the industrial sectors, a ranking of sectors by the amount spent during the 1972-77 period indicates that the engineering and chemical industries were first and second, respectively. Each spent over four billion "deviza-zloty" during this period. The two sectors appear to have been given a special role in modernizing the economy as they were expected not only to supply new machines and materials for the domestic economy but to contribute to new exports as well. The ranking of the ten industries, taken from a table on expenditures from Fallenbuchl (1983, p. 122), is as follows:

A. Industries which spent over 4 billion deviza zloty:

1. Engineering
2. Chemicals

B. Industries which spent 2-4 billion deviza zloty:

3. Metallurgy
4. Light Industry
5. Food and Tobacco
6. Power and Fuel

C. Industries which spent less than 2 billion deviza zloty:

7. Construction
8. Wood and paper
9. Minerals
10. Printing

The question which cannot be clearly answered is what was the ratio of expenditures on imported machinery to domestic machinery or total investment in machinery during this period. The figures for imported machinery are available only in deviza zloty while those for total investment on machines and equipment are in domestic zloty. Moreover, no reliable data exist on the exchange rates between these two currencies. If the exchange rate were 1:1

for the entire 1972-77 period then it would appear that the ratio of imported machinery to total investment outlays was very small and constant, on the order of 2%. However, the 1:1 exchange rate assumption is not realistic and it appears that the proportion of imports to total investment outlays on machinery and equipment was neither small nor constant during the 1972-1976 period. First, Fallenbuchl (1983, pp. 14 and 156) presents data from several Polish sources[1] which claim to have converted deviza zloty into domestic zloty. While no information is provided about the underlying methodology, these figures indicate that (a) the majority of the machines and equipment installed in the country were produced in Poland and (b) the proportion of imported machines (calculated in current domestic prices) was substantial and relatively constant until the early 1970s, when it grew significantly. According to these sources, the share of imports in total investment outlays on machines and equipment in the socialist sector of the entire economy was about 31% between 1957 and 1970. It grew to 36.8% in 1972, reached a peak of 49.0% in 1975, and then declined to 40.1% in 1978 (the latest figure available). The figures for the industrial sector are the highest of all the sectors of the economy, rising from 36.7% in 1970 to a peak of 61.7% in 1975 and declining to 56.0% in 1978.

These figures are consistent with the growth rates for imported machinery as compared with the growth rates for total investment in machinery and equipment (for industry). Fallenbuchl's (1983, p. 125) calculations indicate that in every sector, except power and fuel, investment in machinery did not grow as rapidly as expenditures on imported machinery throughout the 1972-1976 period. In addition, the growth rates for the former did not decline as rapidly in the years which followed.

In our study of productivity, we use "global product" as a measure of

output. For the 1960-83 period the average growth was about 5.5% per annum, with the Engineering and Chemical industries growing at almost twice that rate (10.1% and 9.0%, respectively). During 1972-1977 each sector's output grew at a faster rate than it had during the 1960-1971 period except for Fuels and Energy and Chemicals which remained constant. The largest increases were made in Food and Wood and Paper, the latter jumped from an average rate of 5.6% per annum in the 1960-72 period to 10.6% per annum in the 1972-77 period. Finally, the rate of growth of ouput was negative in each sector during the 1977-1983 years. The sectors hit the hardest appear to have been metallurgy (-2.9% per year) and Light industry (-2.7% per year). Engineering, Fuels and Energy and the Chemical industries experienced the least amount of decline (-.4%, -.3% and -.8% respectively).

The behavior of the employment variable (number of workers) over the 1960-1983 period is worth a brief discussion. It registered little growth (between 1.1% and 1.8% per year) in all of the sectors except Engineering (3.1%) and Chemicals (2.6%). The growth was the fastest in the 1960-1972 period, began to slow down in the the 1972-1977 period (to almost zero growth in many sectors) and became negative during 1977-1983 in all sectors except for Fuels (which registered a 2.3% growth) and Food and Tobacco (which seems to have had zero growth). Hence, the employment situation did not seem to be improved by the economic maneuvre and worsened in the last six years at the same rate (or faster) than the decline of global product. It should be noted however, that not all of this decreased rate of growth was translated into unemployment. Some of it resulted from the increased maternity benefits in the last period and from increased strike activity as well.

The data used for the present study were collected from various Polish Statistical yearbooks (i.e., the general, Foreign Trade, and Industrial

yearbooks). We are grateful to Stanislaw Gomulka for the 1960-1976 time series of the "core" variables -- global output (in 1961 zloty), labor (number employed) and fixed assets (in 1961 zloty). These series were extended to 1983 with data from the statistical yearbook.

A comment shuld be made on the variable for "western technology". We used Fallenbuchl's (1983) 1972-1977 time series on the value of machinery imported from the west by each industrial sector. We followed his methodology to extend the series from 1960 to 1983. These data originate from the Foreign Trade Yearbook's Table of the value of imported machinery, equipment and plants by detailed categories. Whereas in most cases it is fairly clear which machines and plants were purchased by which industrial sector, in some instances it was necessary to expend considerable effort to apportion adequately the imported machines to individual sectors. Having kept the somewhat arbitrary assignments to a minimum, we hope to have created a useful variable both for the present and future studies.

3.2 Production Function Analysis

In order to assess the effect of western technology on productivity, we have estimated several sets of production functions. We begin by estimating the basic Cobb-Douglas function of the form

$$\ell n\, Q = A + \lambda t + \alpha \ell n K + \beta \ell n L \qquad (1)$$

where Q = global product in 1961 prices, A = constant, t = time trend in years, K = total fixed capital in 1961 prices, and L = number of workers. We then proceeded to add dummy variables for the time periods of interest so as to estimate any productivity (efficiency) shifts in these "policy" periods. Because of the way these dummy variables are constructed (D1 = 1 for 1972-1983, and 0 otherwise; D2 = 1 for 1977-1983, and 0 otherwise; etc.) the coefficient for each period represents a shift above (or below) that of the

Table 3.1: **Cobb-Douglas Production Function for all Industries, 1960-83**

Variable	(1)[a] β	(1)[a] t	(2)[a] β	(2)[a] t	(3)[a] β	(3)[a] t
Intercept	5.981	(24.83)	5.523	(38.15)	--	--
Log of Fixed Assets	.049	(5.51)	.052	(6.15)	.071	(4.31)
Log of Labor	.744	(15.19)	.789	(27.82)	.489	(11.66)
Time	.039	(8.33)	.050	(13.79)	.061	(28.78)
D_1= 1 for 1972-83			.011	(.59)	.042	(2.76)
D_2= 1 for 1977-83			.002	(.12)	-.022	(1.52)
D_3= 1 for 1981-83			-.180	(9.37)	-.230	(15.26)
Dummies for:						
Food & Tobacco					7.581	(24.45)
Light Industry					7.151	(22.88)
Wood & Paper					6.762	(24.94)
Engineering					7.764	(22.21)
Fuels & Energy					6.953	(22.15)
Chemicals					7.430	(26.14)
Minerals					6.413	(23.10)
Metallurgy					7.331	(26.36)
Other					6.445	(27.72)
Degrees of Freedom	212		209		201	
Durbin-Watson[b]	.186		.191		.605	

[a]Corrected for autocorrelation using Park's Procedure (J. Kmenta, Elements of Econometrics, N.Y.: MacMillan Co., 1971, pp. 512-14).

[b]Durbin Watson statistic recorded before the correction for autocorrelation.

previous period. Finally, we added a dummy variable for each industrial sector in order to control for industry-specific effects.

The results from estimating these equations are presented in Table 3.1. They indicate that the industry as a whole seems to have experienced slightly decreasing returns to scale with a low coefficient of .05 on capital and higher coefficient of .74 on labor. Addition of the time period dummy variables indicates that, controlling for the use of inputs, the 1972-76 and 1977-81 periods did not experience a significantly different growth of output (i.e., total factor productivity) as compared to the average annual trend rate of 5% for the 1960-1983 period. However, during the last three years (1981-1983), there was a significant average downward shift of -18%.

When the industry specific dummy variables are included (column 3), the regression displays stronger diminishing returns, important industry-specific effects, and great disparities in technological progress (total factor productivity shifts) among the various periods. In particular, the overall annual rate of technological progress is estimated at 6.1%. The period 1972-1976 registers an additional 4.2% increase in total factor productivity, the 1977-1980 period a possible decrease of 2.0% over the 1972-76 period (although statistically it is impossible to reject the hypothesis that the increase was 4.2% in this period as well). Finally, the 1981-1983 registers a decrease of 18.8% (i.e., 23.0% - 4.2%).

The overall analysis therefore indicates that the Polish industry (a) suffers from a very low marginal productivity of capital, (b) displays a strong upward trend in technological progress, (c) registered a significant increase in total factor productivity between 1972 and 1980 (especially during the 1972-76 period) and (d) experienced a dramatic (about 20%) drop in total factor productivity during the 1981-1983 years.

Because the industry specific dummy variables proved to be so important, separate production functions were also estimated for each industry. These estimates (in Table 3.2) show that, counter to the findings above, each industry (except for Minerals and Metallurgy) displays increasing returns to scale and therefore look as if they would profit from a proportional increase in all factors. The coefficient on capital is significantly higher than the average in all industries except Chemicals and Fuels and Energy, where its effects on output seems to be nil. In almost all of the industries the growth of output in the 1972-1976 and 1977-1981 periods was not significantly higher than their industry specific time trend for the whole 1960-1983 period. However, each industry, with the exception of Wood and Paper, experienced strong downward shifts in output during 1981-83, ranging from -14% to -28%.

Therefore a closer look at each sector indicates that: (a) Taken separately, the marginal productivity of capital is not low in most industries, however it appears to be zero in some of them (Metallurgy, Chemicals and Fuels and Energy) which is bringing down the average for the industry as a whole; (b) Six of the nine industries experience increasing returns to scale; (c) Holding constant for factor inputs, output in Fuels and Energy and Chemicals grew the fastest over the 1960-1983 period (9% and 7% per annum, respectively). However, growth of output in the other industries was much slower ranging from -1% to 3% per year. (d) In the 1972-1980 period, the level of output did not change significantly over the 1960-1983 trend for most industries, except Food & Tobacco and Metallurgy where it rose and Fuels and Energy where it fell in 1972-1977. (e) Finally, the level of output dropped dramatically in the 1981-83 period for every industry, except Wood and Paper.

In the second phase of our analysis we tested the relative productivity of domestic and foreign capital. We first estimated the production function

Table 3.2: Separate Cobb-Douglas Production Functions for Each Industry, 1960-1983[a]

Industry	Intercept	Log of Fixed Assets	Log of Labor	Time	Dummy = 1 for: 1972-1983	1977-1983	1981-1983	R^2	D.W.[b]
1. Food & Tobacco	1.56 (1.29)	.59 (8.03)	.63 (4.64)	-.01 (2.32)	.07 (4.63)	.04 (2.44)	-.14 (8.41)	.998	2.00
2. Light Industry[c]	1.56 (1.30)	.40 (4.56)	.85 (7.21)	.02 (4.28)	-.01 (.46)	-.01 (.24)	-.15 (5.53)	.997	1.35
3. Wood & Paper[c]	-1.43 (.81)	.94 (6.06)	.45 (2.36)	.01 (.94)	.02 (.53)	.06 (1.58)	.10 (2.37)	.996	1.52
4. Engineering[c]	- .71 (.51)	.55 (5.24)	.93 (8.36)	.03 (2.30)	.01 (.25)	-.03 (1.03)	-.19 (5.27)	.999	1.09
5. Fuels & Energy[c]	16.37 (3.97)	-.30 (.89)	-.32 (1.46)	.09 (3.67)	.02 (.82)	-.09 (3.51)	-.28 (8.50)	.997	1.67
6. Chemicals[c]	4.58 (4.78)	-.01 (.83)	1.16 (6.17)	.07 (9.32)	.03 (.77)	-.07 (1.87)	-.28 (6.42)	.997	1.58
7. Minerals[c]	1.16 (.60)	.46 (2.55)	.71 (4.58)	.03 (2.97)	.00 (.05)	-.05 (1.61)	-.20 (6.45)	.998	1.15
8. Metalurgy	4.43 (2.03)	.28 (1.44)	.66 (3.12)	.02 (1.37)	.10 (3.20)	-.04 (.79)	-.21 (3.95)	.994	1.89
9. Other[c]	8.97 (2.88)	.09 (.26)	-.21 (.98)	.12 (3.44)	-.05 (.47)	-.26 (2.30)	-.54 (4.59)	.971	1.53

[a] absolute value of t statistics are in parentheses.

[b] Durbin-Watson coefficient (before correction for autocorrelation).

[c] coefficients after regression was corrected for autocorrelation. In all cases the "corrected" and "uncorrected" coefficients are very similar.

under the assumption that domestic and foreign capital stocks may have different productivities but that they are very (infinitely) easily substitutable in production, a model that was, for instance, used by Weitzman (1979) with Soviet data. Letting K_f and K_d represent the foreign and domestic capital stock respectively, the Cobb-Douglas production function may be expressed as

$$Q = Ae^{\lambda t}[K_d + \omega K_f]^{\alpha} L^{\beta} \qquad (2)$$

In this functional specification, the test of whether foreign capital is more productive than domestic capital amounts to testing whether $\omega > 1$. An estimate of $\omega > 1$ ($\omega < 1$) would imply that foreign capital is more (less) productive than domestic capital. The main problem one encounters in estimating an equation such as (2) on East European or Soviet data is how to denominate foreign capital (measured as accumulated and depreciated imports of western machinery and equipment in the same currency (unit) as domestic capital. Weitzman did not grapple with this problem as he simply used Green and Levine's (1976, 1978) data. He mentions that there are "problems of measurements and valuation, especially concerning imported capital" (Weitzman, 1979, p. 169) but he does not worry about testing for different valuations.

In Poland, it is not reasonably possible to convert deviza zloty (in which imported capital is valued) into zloty (in which domestic capital is valued). There are various schemes which have been used but, as their authors readily admit, they have severe drawbacks. As a result, we resort to using a statistical approximation which enables us to estimate equation (2) without having to convert one currency to another. Equation (2) can be rewritten as:

$$Q = Ae^{\lambda t}[K_d + (1 + \varepsilon)K_f]^{\alpha}L^{\beta} \tag{3}$$

where $1 + \varepsilon = \omega$ and the test becomes H_0: $\varepsilon = 0$ vs. H_1: $\varepsilon \neq 0$. Through algebraic manipulation, (3) becomes:

$$Q = Ae^{\lambda t}(K_d + K_f)^{\alpha}\left(1 + \varepsilon \frac{K_f}{K_d + K_f}\right)^{\alpha} L^{\beta} \tag{4}$$

which can be expressed in a logarithmic form as

$$\ell n\, Q \approx \ell nA + \lambda t + \alpha \ell n(K_d + K_f) + \alpha\varepsilon \frac{K_f}{K_d + K_f} + \beta \ell n\, L, \tag{5}$$

where $\ell n\left(1 + \varepsilon \frac{K_f}{K_d + K_f}\right) \approx \varepsilon \frac{K_f}{K_d + K_f}$ since $\varepsilon \frac{K_f}{K_d + K_f}$ is small. If K were expressed in zlotys as is $K_d + K_f$ (total fixed assets), equation (5) could be estimated directly. However, the foreign capital data at our disposal are ϕK_f, where ϕ is the unknown deviza zloty/zloty exchange rate. With this complication, equation (5) can be rewritten as

$$\ell nQ \approx \ell nA + \lambda t + \alpha \ell n(K_d + K_f) + \frac{\alpha\varepsilon}{\phi} \frac{\phi K_f}{K_d + K_f} + \beta \ell nL. \tag{6}$$

Since $\phi > 0$, estimating equation (6) rather than (5) permits us to carry out the test H_0: $\varepsilon = 0$ vs. H_1: $\varepsilon \neq 0$, provided ϕ can be approximated by a constant. If $\varepsilon = 0$, then $\frac{\alpha\varepsilon}{\phi} = 0$; If $\frac{\alpha\varepsilon}{\phi} > 0$ then one can conclude $\varepsilon > 0$, since $\alpha > 0$ by definition of the Cobb-Douglas function.

In order to estimate this model, we needed the stock of western capital which is not readily available. Therefore, we "constructed" western capital by deflating the value of imported foreign capital (machinery, equipment and plants) by import deflators and then we summed these values over the years, depreciating by 15% each year (which drives down the stock to 5% of its

Table 3.3. Variation of the Weitzman Model[a]

Industry	Intercept ($\ell n A$)	Log of Labor (β)	Log of Fixed Assets (α)	Western Capital as a % of Fixed Assets $\frac{\alpha\varepsilon}{\phi}$	Time (λ_1)	Time^2 (λ_2)	R^2	D.W.[b]
Total[c]	7.42 (24.21)	.65 (11.32)	-.01 (.48)	-.02 (2.09)	.08 (7.34)	-.001 (2.40)	.785	.20
Food & Tobacco[c]	-1.70 (.69)	.64 (5.18)	.89 (1.68)	-.12 (1.62)	-.02 (.90)	-.000 (.83)	.991	1.59
Light Industry[c]	1.52 (.76)	.49 (1.04)	.61 (1.89)	-.07 (.97)	.09 (2.22)	-.003 (3.01)	.995	1.40
Wood & Paper	-7.25 (2.32)	1.66 (2.64)	.90 (5.05)	.04 (1.16)	-.08 (1.72)	.002 (1.30)	.996	1.82
Engineering	.67 (.18)	.30 (.55)	.79 (6.20)	-.05 (1.76)	.09 (1.55)	-.003 (1.95)	.998	1.81
Fuels & Energy[c]	13.45 (2.04)	-.57 (.16)	.08 (1.60)	-.09 (1.65)	.11 (2.58)	-.002 (5.31)	.983	1.36
Chemicals[c]	11.40 (3.92)	.07 (.12)	-.14 (3.19)	-.14 (4.38)	.24 (5.19)	-.005 (4.14)	.994	1.44
Minerals	-6.93 (1.81)	1.19 (1.72)	.97 (5.59)	.05 (.45)	-.01 (.13)	-.000 (.26)	.993	2.17
Metallurgy	.06 (.02)	.73 (1.05)	.65 (2.85)	.27 (1.92)	.01 (.26)	-.001 (1.08)	.985	1.09

[a]Absolute values of t statistics in parentheses.

[b]Durbin-Watson statistic before correction for auto-correlation.

[c]Corrected for auto-correlation.

NOTE: Corrected and uncorrected coefficients are very similar.

original value over a 20 year period).

The results from estimating equation (6) are reported in Table 3.3. They indicate that for all industries combined, and for some of the industries taken individually, one cannot reject the hypothesis that $\varepsilon = 0$ and hence that foreign capital is as equally productive as the domestic (COMECON) one. Western technology did have an impact on output in three industries, the three which imported the largest amounts of western capital over the 1972-77 period: Engineering, Chemicals and Metallurgy. Interestingly, the impact for the Engineering industry appears to have been slightly negative and for Chemicals and Metallurgy positive. The size of the effect is difficult to comment on as it depends on what the exchange rate (ϕ) is between the zloty and the deviza zloty. Postulating two average exchange rates for the period, $\phi = 6$ and $\phi = 15$, we find that the corresponding estimates for ε are:

	Estimates for ε when	
	$\phi = 6$	$\phi = 15$
Engineering	-.007	-.003
Chemicals	.167	.067
Metallurgy	.069	.028

Hence, if these rates of exchange bound the possible range over the 1960-1983 period, then western technology had the largest effect in the Chemical industry, being from 6.7% to 16.7% more productive than the domestic capital. In Metallurgy the effect was smaller but still positive (3% to 7% more productive) whereas in Engineering it may have been slightly (.3% to .7%) less productive.

Based on information provided by Fallenbuchl (1983) on pp. 14 and 20 and Tables III.9 and VII.5, we estimate that the exchange rate between the deviza zloty and the domestic zloty for machines and equipment imported from non-socialist countries over the 1970-77 period is approximately 1:6. We

recognize that this is a very tenuous ratio, but it is used simply to get a "ball park" estimate.

Assuming that α = the coefficient on the log of fixed assets, then we divide the coefficient on the log of western capital ($\frac{\alpha\varepsilon}{\phi}$) by this coefficient ($\alpha$) to arrive at the ratio $\frac{\varepsilon}{\phi}$. Dividing this by $\phi = 6$ yields a value of ε of approximately -.01 for Engineering, .17 for Chemicals and .07 for Metallurgy, which indicates that western capital was more productive than domestic in the latter two industries and less productive than domestic capital in Engineering.

The model in equation (2) suffers from the drawback of assuming an infinite elasticity of substitution between domestic and foreign capital. Therefore, we undertook a "sensitivity analysis" to see if different results would be obtained from a different specification. Our aim was to estimate the Cobb-Douglas production function in the form where domestic and foreign capital are treated as separate inputs with a unitary elasticity of substitution:[2]

$$A = A\, e^{\lambda t}\, K_d^{\alpha}\, K_f^{\beta}\, L^{\gamma} \tag{7}$$

We were unable, however, to estimate the log of this Cobb-Douglas function because of data constraints. Whereas we wanted

$$\ell n\, Q = \ell n\, A + \lambda t + \alpha\, \ell n\, K_d + \beta\, \ell n\, K_f + \gamma\, \ell n\, L, \tag{8}$$

we did not have K_d but rather only $K_d + K_f$. However, since:

$$\ell n\, (K_d + K_f) = \ell n[K_d(1 + \frac{K_f}{K_d}) \approx \ell n\, K_d + \frac{K_f}{K_d}\ ,$$

we were able to substitute $\ell n\, (K_d + K_f) - \frac{K_f}{K_d}$ for $\ell n K_d$, where the term

$(\frac{K_f}{K_d})$ was proxied by a polynomial in time.

As we noted in estimating the earlier model, $K_d + K_f$ and K_f are not in the same monetary units. In the present model, however, it does not present a problem.

Now with this model specification we can attempt to answer two questions. One is to what extent were resources allocated efficiently among the different sectors. The second is whether more or less western capital (domestic capital and labor) should have been used for a given level of output.

We cannot fully answer the first question since we do not have the relative prices of these factors. However, judging by the returns to scale, we can indicate whether a presumption exists that the quantity of output in a given sector should have been increased or decreased by increasing (decreasing) the scale of operation. For example if $\alpha + \beta + \gamma > 1$ and $\beta > 0$ whereas $\alpha + \gamma < 1$, then one can argue that the lack of K_f was an important constraint on production and that its importation led to increasing the returns to scale.

Therefore looking at the results of Table 3.4, the sectors which should have increased their output were Food and Tobacco, Wood and Paper and Metallurgy. However, in none of these sectors was western capital useful in increasing output ($\beta = 0$).

To answer the second question, note that we are essentially selecting the best point on a given isoquant (level of output). Therefore we are testing whether the marginal product of K_f $(\beta \frac{Q}{K_f})$ is greater than the marginal product of $K_d(\alpha \frac{Q}{K_d})$. However since the β coefficients were zero or negative for all

Table 3.4 Cobb-Douglas Production Functions for Poland, Separating Out Western Capital 1960 - 1983[a]

Industry	Inter-cept	Log of Labor	Log of (Fixed Assets) (K_d+K_f)	Log of Western Capital (ϕK_f)	Time	Time^2	R^2	D.W.[b]
Total	6.83	.70	.02	-.01	.067	-.001		.22
	(20.75)	(11.71)	(4.37)	(.91)	(6.08)	(1.57)		
Food & Tobacco[c]	-2.95	.58	1.04	-0.034	-.020	-.001	.986	1.61
	(0.99)	(1.47)	(7.40)	(1.04)	(1.06)	(1.79)		
Light Industry	4.02	.34	.80	-0.210	.110	-.003	.998	1.98
	(3.24)	(1.21)	(7.26)	(4.07)	(5.71)	(5.24)		
Wood & Paper	-4.88	1.55	.79	0.072	-.072	.002	.996	1.97
	(2.46)	(3.40)	(4.58)	(1.71)	(2.58)	(1.70)		
Engineering[c]	-0.80	.51	.91	0.059	.058	-.002	.998	1.73
	(0.22)	(.88)	(7.90)	(1.12)	(1.02)	(1.46)		
Fuels & Energy[c]	18.64	-0.53	.23	0.173	.111	-.002	.981	1.29
	(1.85)	(1.45)	(.47)	(1.42)	(2.48)	(4.60)		
Chemicals[c]	15.95	.50	.02	-0.173	.202	-.003	.992	1.44
	(5.05)	(.77)	(.66)	(2.97)	(3.89)	(3.03)		
Minerals	-5.06	.93	.97	-0.002	.013	-.001	.993	2.07
	(1.43)	(1.37)	(5.14)	(0.03)	(.33)	(.71)		
Metalurgy	3.43	1.23	.44	0.033	-.008	-0.0001	.968	.75
	(1.00)	(2.15)	(2.15)	(0.68)	(.25)	(0.08)		

[a]Absolute value of t statistics in parenthesis.

[b]Durbin-Watson statistic before regression was corrected for autocorrelation.

[c]Coefficients from regression corrected for autocorrelation.

the industry's, it is not necessary to make the calculations with the average product. It is clear that the marginal productivity of western capital was zero in all industries except Light industry and Metallurgy, where it was significantly negative.

3.3 Conclusions

In this chapter three specifications of the Cobb-Douglas production function were estimated using data on global product, fixed assets, non-socialist imported capital, and number of workers in each industry over the 1960-1983 period. The results from the three models are consistent for total industry estimates. They indicate that overall Polish industry (a) suffers from a low productivity of capital, (b) displays decreasing returns to scale, and (c) registers a fairly strong positive trend in technological progress. In the first model, when time period dummy variables were also included, there appears to have been a slight rise in total factor productivity during the 1972-1976 as well as 1977-1980 period as compared with the overall 1960-1983 trend. There was a definite decline during the 1981-1983 period.

With respect to the marginal productivity of western capital, the latter two models (Tables 3.3 and 3.4) suggest that for industry as a whole, it was zero. The industry-specific results of Table 3.4 support these aggregate findings by registering a negative marginal product of western capital in both light industry and Metallurgy and zero elsewhere.

The model where K_d and K_f are included additively (Table 3.3) indicates that the relative (average and marginal) productivity differential between the foreign (western) and domestic (COMECON) capital was positive for Chemicals

and Metallurgy, negative for Engineering and zero elsewhere.

The main conclusion of this chapter is hence that, while in two industries (chemicals and metallurgy) western capital may have boosted productivity, on the whole the massive importation of western technology did not seem to have the desired effects on productivity of Polish industry.

Footnotes for Chapter 3

[1] G.U.S. Investment 1979, Warsaw 1979, pp. 11-14, 18-19, P. Bozyk and B. Wojciechowski, Foreign-Trade of Poland 1945-1969, Warsaw 1971, p. 322; B. Wojciechowsi, Foreign Trade and National Income of Poland, Warsaw 1977, p. 187.

[2] Weitzman considers this a bad specification because he feels the elasticity of substitution between K_d and K_f should be greater than the elasticity of substituion between K and L, and this model constrains them all to be 1. However, Green (1979, p. 179) disagrees citing the relative scarcity of foreign equipment in the Soviet Union during that period.

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4. The Macro-economic (Input-Output) Analysis of Optimal Demand-Oriented Policy

4.1 Introduction

Given our findings from Chapters 2 and 3 about the micro and sectoral impact of technology transfers on exports and growth, we now take a macro economic approach and use a general equilibrium, input-output (I-O) methodology to analyze the impact of various possible policies and exogenous shocks on major traditional performance indicators. Moreover, while Chapters 2 and 3 focused on the supply-side problems that may have plagued the Polish economy and the extent to which Western technology alleviated these supply-side bottlenecks, the analysis of this Chapter focuses on the demand side and identifies optimal policies within given technological (productive) frameworks. We use the 1969 and 1977 official Polish input-output tables which permit us to identify the optimal demand-oriented policies both before and after the major investments and imports of western technology took place.

In view of the questionable effect of technology imports on growth at the sectoral level, our approach in this chapter enables us to point out (a) how resources could have been used effectively on the demand instead of on the supply side and (b) what the most effective demand-oriented policies would be once the major investments and technology imports took place between 1971 and 1976. In particular, this chapter examines what might be called optimal demand-side oriented industrial policy.

One of the primary concerns of the Polish industrial policy since 1968 has been a successful export performance of individual sectors [see e.g. Brada and Montias (1984)]. While some aspects of this policy vaguely and indiscriminately aimed at increasing the external demand for Polish products through better and more aggressive marketing abroad (especially outside COMECON), most attention and resources were devoted to the supply side - namely shifting the supply curve

down by producing cheaper and higher-quality products with western technology. In view of the limited detectable success of this policy at the sectoral level, it is of interest to explore what would have been and what would now be the optimal demand-side policy. Specifically, if resources were to be expended on better marketing of Polish products abroad (shifting the demand curve out) or selective subsidies (moving down along an elastic demand curve), which industries ought to have received or ought now to receive priority?

The methodology that we use is general in that the identified priorities apply to domestically generated as well as export driven demand. Section 4.2 contains the general methodology underlying our macro-economic investigation. Section 4.3 presents the main results and Section 4.4 draws the principal conclusions.

4.2 Methodology

The basic aim of this chapter is to calculate the impact of a change in final demand (brought about for instance by an induced increase in exports) on major performance indicators. The methodology focuses on the increase in final demand of an individual sector as well as the increase in final demand of all sectors simultaneously.

In technical terms, the basis for our analysis can be described as follows. We assume that the production processes can be approximated by production functions which at a given point in time display constant technical coefficients and constant returns to scale. Let

X_i = the annual volume of total output of industry i,

x_{ij} = the amount of industry i's product absorbed annually as an intermediate input by industry j,

Y_i = the amount of product i used to satisfy final demand,

$a_{ij} = x_{ij}/X_j \quad i = 1,\ldots,n, \quad j=1,\ldots,n.$

It follows that

$$\sum_{j=1}^{n} x_{ij} + Y_i = X_i \qquad i=1,\ldots,n.$$

Letting X be the vector (X_i), Y be the vector (Y_i), A be the matrix (a_{ij}), and I be the identify matrix, the system in (4) may be rewritten as

$$X - AX = Y \tag{4.1}$$

or

$$(I-A)X = Y, \tag{4.2}$$

where (I-A) is the Leontief matrix. Letting $R = (I-A)^{-1}$ be the inverted Leontief matrix, we can describe the relationship between the vector of total inputs (X) and the vector of total final demands (Y) by the equation

$$X = R \cdot Y. \tag{4.3}$$

Moreover, it follows that

$$\Delta X = R \cdot \Delta Y, \tag{4.4}$$

where ΔX represents the change in total output corresponding to the change ΔY in final demand.

Our strategy is first to calculate the so-called linkage effects of a one unit (measured in value terms) and one percent increase in the final demand for the product of any given industry and then to calculate the effect of a one unit or one percent increase in the final demand for the product of all industries simultaneously.

Taking the linkage effects first, we calculate the total inter-industry linkage (PL_j), the inter-industry employment linkage (EL_j) and the inter-industry income generation (YL_j). The total inter-industry linkage effect of a one zloty increase in the final demand (e.g. exports) for the product of any given industry on the total output of this and every other industry can be

obtained from the R matrix as follows

$$PL_j = \sum_i r_{ij} = \sum_i (1-a_{ij})^{-1}, \qquad (4.5)$$

where $r_{ij} = (1-a_{ij})^{-1}$ is the ijth element of the inverted Leontief matrix.

The inter-industry employment linkage is the total effect of a one unit increase in any element j of final demand (Y_j) on the use of labor expressed in value terms (i.e. the wage bill). To compute the employment linkage, each sector's utilization of labor (in value terms) is expressed relative to that sector's total production --$\ell_j = L_j/X_j$. The expression ℓ_j is thus the labor coefficient or the value of labor input per unit of output of sector j. Since the elements of column j of the inverse matrix express the output required in each sector i per unit of final demand for commodity j, the employment linkage effect is obtained by multiplying the labor coefficient by the elements of the inverse and by summing the row elements in each column:

$$EL_j = \sum_i \ell_i r_{ij} = \sum_i \ell_i (1-a_{ij})^{-1}. \qquad (4.6)$$

The employment linkage EL_j thus expresses the importance of different sectors' final demand on employment (wage bill) generation.

The total and employment inter-industry linkages ignore the level of income, basically assuming that income is independent of the structure of production and effectively exogenous to the entire system. This assumption is unlikely to be satisfactory and we therefore also calculate the inter-industry income generation linkage YL_j. The income generation linkage is based on the assumption that, as employment is determined in part by the inter-industry structure, wage payments endogenously determine household income. Households' marginal propensity to consume in turn affects the structure of final demand.

This induced household demand further stimulates a sector's demand for intermediate products and labor, thus generating further indirect effects on household income. The income generation linkage captures this process. It must be noted that the construction of the income generation linkage assumes that income from capital and rents is relatively unimportant for the household. In a centrally planned socialist economy such as Poland's, this assumption is of course much more valid than it would be in a framework of a capitalist country.

In computing the income generation linkage, the inter-industry input coefficients matrix A is augmented by one row and one column vector. The row vector is the vector of labor income coefficients ℓ_j obtained from the value added quadrant of the input-output table. The extra column is obtained by dividing every entry in the household consumption column of the final demand quadrant by total household income. The original $(n \times n)$ A matrix has thus been converted to a new matrix D_{ij} which is of the dimension $(n + 1) \times (n+1)$. The last column of this matrix gives the household sector's marginal (equal to the average) propensity to consume the output of each industry i, while the last row denotes the labor input coefficients (in value terms) ℓ_j. The transformation amounts to making the household demand an induced component of demand, while government investment and export demand remain automomous. The income generation linkage YL_j is given by the last $(n + 1)$ th row of the inverted matrix $(I - D)$, i.e. $(I-D)^{-1}$.

All three inter-industry linkages give the impact of a one Zloty increase in the final demand in a given sector on the output, employment (wage bill) and total income, respectively, of the entire economy. They provide an important understanding of the impact of a one zloty increase in for instance exports on output, employment and income in the economy. As such, they are usually

important indicators in setting the priorities for investment or export promotion. However, to the extent that a given effort (cost) applied toward increasing export demand (e.g. through better marketing abroad) leads to similar percentage rather than absolute increases in export levels of different industries, it is also useful to express the three linkage effects in terms of a one percent increase in exports.

Finally, rather than focusing on the effect of increasing final demand (e.g. exports) of a given industry, it may be of interest to see the impact of a simultaneous increase in the final demand (e.g. exports due to devaluation) in all the sectors of the economy. The effect on output of such a change is given by equation (4.4) and it can be expressed in absolute values [as in equation (4.4)] or in percentage terms. Analogously to equation (4.4), the changes in employment, imports and total capital brought about by a change in final demand (e.g. exports) can be calculated as follows:

$$\Delta L = \sum_{i=1}^{n} \ell_i^* \left(\sum_{j=1}^{n} r_{ij} \Delta Y_j \right) \tag{4.7}$$

where $\ell_i^* = L_i^*/X_i$ with L_i^* being the <u>number of workers</u> in sector i,

$$\Delta M = \sum_{i=1}^{n} m_i \left(\sum_{j=1}^{n} r_{ij} \Delta Y_j \right) \quad \text{and} \tag{4.8}$$

$$\Delta K = \sum_{i=1}^{n} k_i \left(\sum_{j=1}^{n} r_{ij} \Delta Y_j \right), \tag{4.9}$$

where $m_i = M_i/X_i$, with M being the value of imports of sector i and $k_i = K_i/X_i$ with K being the value of the total capital stock in sector i.

Equations (4.7),(4.8) and (4.9) can be expressed as absolute changes or percentage changes. In Section 4.3 we present the results of both the absolute and percentage effect calculations.

4.3 Main Results

The calculated linkage effects are given for 1969 and 1977 in Tables 4.1 and 4.2 respectively. Table 4.1 hence refers to the situation as it existed before the major reforms including the major importation of western technology took place, while Table 4.2 refers to the subsequent period and provides also indication of what the current situation might look like. In all the calculations that have been undertaken in this section, it turns out that the employment linkage (EL_j) and income generation linkage (YL_j) have identical rankings. This means that although the effects of endogenizing income determination are quantitatively different from the results obtained when income is treated as exogenous, the ranking of industries is not affected by this extension.

As Table 4.1 indicates, apart from "other" products (1) and "other" industrial production (3), the total interindustry linkage (PL_j) is the highest in metallurgy (2), food industry (4), agriculture (5), light industry (6), construction (7), electromachinery (8), wood and paper (9), and chemicals (10). The income generation and employment linkages indicate that the highest linkage effect occurs, apart from "other" products (1) and "other" industries (5), in the services (2), agriculture (3), construction (4), metallurgy (6), transportation (7), forestry (8), wood and paper (9), food (10), and light industries (11). Considering the three sets of linkages together therefore indicates that the prime targets of industrial policy based on demand induced growth and welfare improvement would be metallurgy, agriculture, food industry, construction, light industry, wood and paper, and electromachinery.

Table 4.2 presents more recent results which are also based on much finer disaggregation of the individual sectors. As this table indicates, the ranking

Table 4.1: Poland--Total Interindustry, Employment and Income Generation Linkages and Their Rankings in 1969

Industry	Total Interindustry Linkage (PL_j)		Employment Linkage (EL_j)		Income Generation Linkage (YL_j)	
1. Fuel & Energy	1.747	(12)	0.480	(13)	1.116	(13)
2. Metallurgy	2.915	(2)	0.583	(6)	1.355	(6)
3. Electromachinery	2.103	(8)	0.463	(14)	1.076	(14)
4. Chemicals	2.006	(10)	0.397	(15)	0.923	(15)
5. Minerals	1.880	(11)	0.488	(12)	1.134	(12)
6. Wood & Paper	2.082	(9)	0.528	(9)	1.228	(9)
7. Light Ind.	2.261	(6)	0.505	(11)	1.175	(11)
8. Food Ind.	2.616	(4)	0.524	(10)	1.218	(10)
9. Other Ind's.	2.695	(3)	0.607	(5)	1.410	(5)
10. Construction	2.163	(7)	0.654	(4)	1.520	(4)
11. Agriculture	2.309	(5)	0.657	(3)	1.528	(3)
12. Forestry	1.527	(15)	0.539	(8)	1.253	(8)
13. Transportation	1.624	(13)	0.571	(7)	1.327	(7)
14. Services	1.605	(14)	0.728	(2)	1.693	(2)
15. Other Products and Mat. Services	3.346	(1)	1.466	(1)	3.407	(1)

Note: The calculations are based on the 1969 official Polish input-output table. Values in parentheses are the rankings. Linkages are expressed in 1969 Zlotys.

Table 4.2: Poland--Total Interindustry, Employment and Income Generation Linkages and Their Rankings in 1977

Industry	Total Inter-Industry Linkage (PL_j)	Employment Linkage (EL_j)	Income Generation Linkage (YL_j)
1. Coal	1.871 (29)	0.617 (7)	1.027 (7)
2. Fuel	1.667 (35)	0.114 (39)	0.190 (39)
3. Electrical & Steam Energy	2.043 (20)	0.431 (20)	0.717 (20)
4. Ferrous Metals	2.358 (11)	0.300 (31)	0.499 (31)
5. Non-ferrous Metals	2.634 (6)	0.291 (32)	0.484 (32)
6. Metal Products	2.078 (19)	0.350 (26)	0.582 (26)
7. Machines & Equipment	1.917 (24)	0.325 (28)	0.542 (28)
8. Fine Mechanics	1.684 (34)	0.301 (30)	0.501 (30)
9. Transport Equipment	2.228 (13)	0.377 (25)	0.628 (25)
10. Electrotechnical & Electronic Products	2.097 (17)	0.337 (27)	0.560 (27)
11. Chemicals	1.921 (23)	0.247 (37)	0.411 (37)
12. Construction Mats.	2.102 (16)	0.455 (15)	0.758 (15)
13. Glass & Ceramics	1.880 (27)	0.446 (16)	0.743 (16)
14. Wood	2.186 (14)	0.418 (22)	0.695 (22)
15. Paper	1.906 (26)	0.288 (34)	0.479 (34)
16. Textiles	1.968 (21)	0.290 (33)	0.483 (33)
17. Apparel	2.455 (10)	0.434 (18)	0.723 (18)
18. Leather	2.640 (5)	0.434 (19)	0.723 (19)
19. Meat	4.258 (1)	0.421 (21)	0.700 (21)
20. Other food	2.543 (7)	0.267 (35)	0.445 (35)
21. Other Ind's	2.755 (3)	0.305 (29)	0.508 (29)
22. General Construction	2.284 (12)	0.519 (10)	0.864 (10)
23. Constrution for Production & Services	2.541 (8)	0.640 (5)	1.065 (5)
24. Specialized Constr.	1.938 (22)	0.402 (23)	0.668 (23)
25. Other Construction	1.568 (38)	0.503 (12)	0.837 (12)
26. Plants	1.585 (37)	0.130 (38)	0.216 (38)
27. Livestock	2.859 (2)	0.248 (36)	0.413 (36)
28. Agric. Services	2.513 (9)	0.475 (14)	0.790 (14)
29. Forestry	1.761 (32)	0.438 (17)	0.729 (17)
30. Transport & Communication	1.846 (30)	0.485 (13)	0.807 (13)
31. Trade	1.700 (33)	0.560 (9)	0.931 (9)
32. Material Services	2.143 (15)	0.510 (11)	0.849 (11)
33. Housing	1.874 (28)	0.400 (24)	0.665 (24)
34. Education	1.816 (31)	0.749 (3)	1.246 (3)

Table 4.2 (Continued)

35. Arts & Culture	2.091 (18)	0.871 (2)	1.450 (2)
36. Health	1.909 (25)	0.716 (4)	1.192 (4)
37. Recreation & Tourism	2.662 (4)	0.587 (8)	0.978 (8)
38. Other Nonmaterial Services	1.655 (36)	0.622 (6)	1.034 (6)
39. Science, Technology & State Services	1.000 (39)	0.875 (1)	1.456 (1)

Note: The calculations are based on the 1977 official Polish input - output table. Values in parentheses are the rankings. Linkages are expressed in 1977 Zlotys.

of individual industries in the decreasing order of the total interindustry linkage (PL_j) is food production [meat (1), livestock (2), and other food (7)], tourism (4), leather (5), metallurgy [non-ferrous metallurgy (6), ferrous metallurgy (11)], construction [construction for production and services (8), general construction (12), and construction materials (16)], agricultural (9) and material (15) services, transport equipment (13), wood production (14), and electrotechnical and electronic products (17). The employment and income generation linkages on the other hand point to the importance of various services, followed by construction, coal production, tourism, material and agricultural services, and glass and ceramics.

Except for tourism, construction, and material and agricultural services, there hence appears to be a divergence in the set of priorities between the total interindustry linkage and the employment and income generation linkages in 1977. However, taking the total interindustry linkage as the principal performance indicator and comparing its industry ranking over time indicates that the same industrial sectors retained their relative position. Thus metallurgy, food, agriculture, light industries and construction still retain their importance, although by using the 1977 disaggregated table one can hypothesize that it is meat and livestock production that seems to have determined the importance of agriculture in 1969. The important deviation between 1969 and 1977 in terms of the total interindustry linkage appears to be the rising importance of tourism (which was not identifiable as a separate sector in 1969) and the relatively low ranking of electrotechnical and electronic products in 1977 (ranked 17). In terms of light industry, apparel production seems to be the most important element as indicated by the 1977 calculations.

Tables 4.3 and 4.4 give the various linkage effects in percentage terms for

Table 4.3: Poland--Total Interindustry, Employment and Income Generation Linkage Effects of a 1 Percent Increase in Exports of a Given Industry in 1969

1% Increase in Exports of Industry	Total Inter-Industry Linkage Effect (% PL_j)		Employment Linkage Effect (% EL_j)		Income Generation Linkage Effect (% YL_j)	
1. Fuel & Energy	270.58	(5)	74.37	(4)	172.89	(4)
2. Metallurgy	338.91	(3)	67.79	(5)	157.58	(5)
3. Electromachinery	996.68	(1)	219.38	(1)	509.98	(1)
4. Chemicals	215.95	(6)	42.73	(8)	99.32	(8)
5. Minerals	32.22	(12)	8.36	(12)	19.44	(12)
6. Wood & Paper	78.52	(9)	19.93	(10)	46.33	(10)
7. Light Ind.	337.70	(4)	75.45	(3)	175.38	(3)
8. Food Ind.	587.52	(2)	115.88	(2)	269.37	(2)
9. Other Ind's	42.63	(11)	9.60	(11)	22.31	(11)
10. Construction	5.84	(15)	1.77	(15)	4.10	(15)
11. Agriculture	180.35	(7)	51.33	(7)	119.33	(7)
12. Forestry	7.31	(14)	2.58	(14)	6.00	(14)
13. Transportation	163.97	(8)	57.64	(6)	134.00	(6)
14. Services	69.01	(10)	31.31	(9)	72.77	(9)
15. Other Products & Mat. Services	9.47	(13)	4.15	(13)	9.64	(13)

Note: The calculations are based on the 1969 official Polish input-output table. Values in parentheses are the rankings. Linkage effects are expressed in 1969 Zlotys.

Table 4.4: Poland--Total Interindustry, Employment and Income Generation Linkage Effects of a 1 Percent Increase in Exports of a Given Industry in 1977

1% Increase in Exports of Industry	Total Inter-Industry Linkage Effect ($\%\ PL_j$)		Employment Linkage Effect ($\%\ EL_j$)		Income Generation Linkage Effect ($\%\ YL_j$)	
1. Coal	1160.2	(2)	382.9	(1)	637.1	(1)
2. Fuel	259.7	(15)	17.8	(19)	29.6	(19)
3. Electrical & Steam Energy	16.3	(28)	3.4	(28)	5.7	(28)
4. Ferrous Metals	376.3	(10)	47.9	(13)	79.7	(13)
5. Non-ferrous Metals	398.9	(9)	44.1	(15)	73.4	(15)
6. Metal Products	361.6	(11)	60.8	(10)	101.2	(10)
7. Machines & Equipment	829.4	(5)	140.8	(4)	234.3	(4)
8. Fine Mechanics	244.9	(16)	43.8	(16)	72.9	(16)
9. Transport Equipment	1470.0	(1)	248.8	(2)	414.1	(2)
10. Electrotechnical & Electronic Products	874.1	(4)	140.4	(5)	233.6	(5)
11. Chemicals	738.1	(6)	95.0	(6)	158.0	(6)
12. Construction Mat.	47.7	(24)	10.3	(24)	17.2	(24)
13. Glass & Ceramics	48.3	(23)	11.5	(23)	19.1	(23)
14. Wood	232.6	(18)	44.4	(14)	74.0	(14)
15. Paper	8.8	(30)	1.3	(30)	2.2	(30)
16. Textiles	348.1	(13)	51.3	(11)	85.3	(11)
17. Apparel	351.5	(12)	62.2	(9)	103.4	(9)
18. Leather	237.0	(17)	39.0	(17)	64.9	(17)
19. Meat	502.9	(8)	49.7	(12)	82.7	(12)
20. Other food	625.2	(7)	65.8	(8)	109.4	(8)
21. Other Ind's	45.4	(26)	5.0	(27)	8.4	(27)
22. General Construction	81.5	(21)	18.5	(18)	30.8	(18)
23. Construction for Production & Services	272.2	(14)	68.5	(7)	114.1	(7)
24. Specialized Constr.	65.2	(22)	13.5	(22)	22.5	(22)
25. Other Constr.	2.0	(31)	0.6	(31)	1.1	(31)
26. Plants	116.6	(20)	9.5	(26)	15.9	(26)
27. Livestock	168.9	(19)	14.6	(21)	24.4	(21)
28. Agric. Services	0.0		0.0		0.0	
29. Forestry	40.0	(27)	10.0	(25)	16.6	(25)
30. Transport & Communication	898.4	(3)	236.1	(3)	392.9	(3)
31. Trade	46.3	(25)	15.3	(20)	25.4	(20)
32. Material Services	12.3	(29)	2.9	(29)	4.9	(29)
33. Housing	0.0		0.0		0.0	
34. Education	0.0		0.0		0.0	
35. Arts & Culture	0.0		0.0		0.0	
36. Health	0.0		0.0		0.0	
37. Recreation & Tourism	0.0		0.0		0.0	
38. Other Non material Services	0.0		0.0		0.0	
39. Science, Technology & State Services	0.0		0.0		0.0	

Note: The calculations are based on the 1977 official Polish input-output table. Values in parentheses are the rankings. Linkage effects are expressed in 1977 zlotys.

1969 and 1977, respectively. As Table 4.3 indicates, in 1969 electromachinery, food, metallurgy, light industry, and agriculture had important total interindustry linkages even in percentage terms. This means that these sectors ranked high in the effect of both a one zloty and one percent increase in exports on the output of the Polish economy. However, other industries (fuel and energy, chemicals, transportation, and wood and paper) also become important when the effect of a one percent increase in exports on output is considered. The employment and income generation linkages point to the importance of the same industries when the percentage effect is taken into account and electromachinery, food, metallurgy, light industry, fuel and energy, agriculture, and chemicals thus become the highest ranking sectors from the standpoint of a percentage effect of exports on industry output.

The calculations of the linkage affect of a one percent increase in exports for 1977 are reported in Table 4.4. They indicate that the total interindustry effect rankings of individual industries are, in the decreasing order, transport equipment (1), coal (2), transport and communications (3), electrotechnical and electronic products (4), machines and equipment (5), chemicals (6), other food (7), meat (8), nonferrous metals (9), ferrous metals (10), metal products (11), apparel (12), and textiles (13). These results point to the importance of the more traditional sectors such as coal and chemicals which were not previously picked up by the other calculations. The employment and income generation linkage effects for 1977 also stress the importance of these sectors with the rankings being coal (1), transport equipment (2), transport and communication (3), machines and equipment (4), electrotechnical and electronic products (5), chemicals (6), construction for production and services (7), other food (8), apparrel (9), metal products (10), textiles (11), meat production (12), ferrous metals (13), wood production (14), and nonferrous meals (15). The three sets of

linkages thus point to the importance of transport equipment production, coal production, transport and communication, electrotechnical and electronic products, machines and equipment, chemicals, food, metalurgy, metal products, and apparel and textiles. It should be noted however that the percentage effect is probably less indicative of the importance of the individuals sectors from the demand oriented industrial strategy than the absolute linkage effects reported in Tables 4.1 and 4.2. This is because the cost (effort) of generating a one Zloty increase in final demand (e.g. exports) is usually more comparable across industries than the cost (effort) of generating a one percent increase.

Tables 4.5 and 4.6 report the calculated effects of a one percent simultaneous increase in exports of all industries on the output of individual industries. The two tables provide the results for 1969 and 1977, respectively, and they indicate that the ranking of the output effect is similar in absolute and in percentage terms. As Table 4.5 indicates, in 1969 the most important output effect is registered in electromachinery, production, metallurgy, fuel and energy, agriculture, food industry, light industry, and chemicals. As these calculations indicate, if exports were to grow proportionately in all industries (e.g. due to an overall increase in the world economic activity), then it is the above mentioned industries that would register the greatest overall demand for their output. Table 4.6 demonstrates that in 1977 the same industries were ranked high although perhaps in a slightly different order. Again the industries with the highest output effect were transport equipment, chemicals, transport and communications, machines and equipment, metalurgy, coal and fuel production, electrical and electronic products, and textiles.

The final set of calculations, reported in Tables 4.7 and 4.8, identifies the effects of a one percent increase in exports of all industries on employment imports and total capital requirement of individual industries. The import and

Table 4.5: Poland--Industry-specific Output Effects of a 1 Percent Increase in Exports of All Industries in 1969

Industry	Output Effect (in 1969 Zloty)	(Rank)	Output Effect (as a % of 1969 Output Level)	(Rank)
1. Fuel & Energy	359.9	(4)	0.28	(2)
2. Metallurgy	486.7	(2)	0.41	(1)
3. Electromachinery	734.2	(1)	0.22	(3)
4. Chemicals	251.0	(7)	0.22	(4)
5. Minerals	56.6	(11)	0.12	(10)
6. Wood & Paper	91.6	(10)	0.16	(8)
7. Light Ind.	278.7	(6)	0.17	(7)
8. Food Ind.	305.7	(5)	0.12	(11)
9. Other Ind's.	44.2	(12)	0.14	(9)
10. Construction	26.6	(13)	0.02	(15)
11. Agriculture	370.4	(3)	0.12	(12)
12. Forestry	25.5	(14)	0.18	(6)
13. Transportation	187.0	(8)	0.19	(5)
14. Services	93.3	(9)	0.09	(13)
15. Other Products & Mat. Services	16.5	(15)	0.09	(14)

Note: The calculations are based on the 1969 official Polish input-output table.

Table 4.6: Poland--Industry-specific Output Effects of a 1 Percent Increase in Exports of All Industries in 1977

Industry	Output Effect (in 1977 Zloty)	(Rank)	Output Effect (as a % of 1977 Output Level	(Rank)
1. Coal	759.0	(6)	0.59	(1)
2. Fuel	532.9	(9)	0.30	(7)
3. Electrical & Steam Energy	146.0	(19)	0.19	(17)
4. Ferrous Metals	760.8	(5)	0.33	(5)
5. Non-ferrous Metals	638.4	(8)	0.53	(2)
6. Metal Products	438.4	(11)	0.24	(10)
7. Machines & Equipment	788.3	(4)	0.23	(12)
8. Fine Mechanics	186.9	(16)	0.34	(4)
9. Transport Equipment	946.9	(1)	0.31	(6)
10. Electrotechnical & Electronic Products	647.1	(7)	0.36	(3)
11. Chemicals	891.1	(2)	0.28	(8)
12. Construction Mats.	136.5	(22)	0.13	(21)
13. Glass & Ceramics	55.9	(29)	0.21	(15)
14. Wood	210.6	(15)	0.19	(18)
15. Paper	71.7	(28)	0.16	(19)
16. Textiles	459.5	(10)	0.19	(16)
17. Apparel	173.1	(17)	0.21	(14)
18. Leather	134.0	(23)	0.22	(13)
19. Meat	161.6	(18)	0.14	(20)
20. Other food	365.9	(13)	0.08	(28)
21. Other Ind's.	129.6	(24)	0.12	(22)
22. General Construction	46.8	(30)	0.03	(34)
23. Construction for Production & Services	144.5	(20)	0.08	(29)
24. Specialized Constr.	92.1	(25)	0.06	(30)
25. Other Construction	23.4	(32)	0.04	(32)
26. Plants	422.2	(12)	0.11	(25)
27. Livestock	315.9	(14)	0.10	(26)
28. Agric. Services	13.6	(35)	0.11	(23)
29. Forestry	73.9	(27)	0.24	(11)
30. Transport & Communication	829.7	(3)	0.26	(9)
31. Trade	137.9	(21)	0.05	(31)
32. Material Services	76.8	(26)	0.11	(24)
33. Housing	16.0	(34)	0.04	(33)
34. Education	1.3	(37)	0.002	(39)

Table 4.6 (Continued

35. Arts & Culture	0.7	(39)	0.01	(37)
36. Health	1.3	(38)	0.003	(38)
37. Recreation & Tourism	2.2	(36)	0.01	(36)
38. Other Nonmaterial Services	21.2	(33)	0.09	(27)
39. Science, Technology & State Services	26.9	(31)	0.03	(35)

Note: The calculations are based on the 1977 official Polish input-output table. Values in parentheses are the rankings.

Table 4.7: Poland--Effects of a 1 Percent Increase in Exports of All Industries on Employment, Imports and Total Capital in 1969

Industry	Employment (Workers)	(Rank)	Imports (Thousand Zl.)	(Rank)	Total Capital (Million Zl.)	(Rank)
1. Fuel & Energy	1,255	(5)	32.1	(4)	678.8	(2)
2. Metallurgy	960	(6)	95.6	(2)	454.8	(5)
3. Electromachinery	2,726	(2)	123.6	(1)	486.8	(4)
4. Chemicals	598	(8)	42.1	(3)	218.6	(6)
5. Minerals	348	(12)	3.5	(12)	80.3	(10)
6. Wood & Paper	455	(11)	5.7	(8)	68.2	(12)
7. Light Ind.	1,374	(4)	12.2	(7)	139.9	(9)
8. Food Ind.	533	(10)	12.9	(6)	161.5	(8)
9. Other Ind's.	206	(15)	4.3	(10)	28.9	(14)
10. Construction	214	(14)	0.0		13.2	(15)
11. Agriculture	6,267	(1)	29.1	(5)	532.3	(3)
12. Forestry	331	(13)	3.5	(11)	29.7	(13)
13. Transportation	1,890	(3)	4.5	(9)	691.7	(1)
14. Services	898	(7)	0.0		192.5	(7)
15. Other Products & Mat. Services	577	(9)	0.2	(13)	75.2	(11)
Total Effects	18,633		369.3		3,852.4	

Note: The calculations are based on the 1969 official Polish input-output table.

Table 4.8: Poland--Effects of a 1 Percent Increase in Exports of All Industries on Employment, Imports and Total Capital in 1977

Industry	Employment (Workers)	(Rank)	Imports (Thousand Zl.)	(Rank)	Total Capital (Million Zl.)	(Rank)
1. Coal	2,103	(3)	10.0	(17)	827.5	(2)
2. Fuel	150	(30)	181.4	(4)	254.1	(11)
3. Electrical & Steam Energy	237	(25)	0.9	(27)	429.5	(8)
4. Ferrous Metals	681	(11)	201.5	(2)	445.2	(6)
5. Non-ferrous Metals	462	(15)	94.7	(6)	330.2	(10)
6. Metal Products	1,003	(8)	64.0	(9)	192.9	(14)
7. Machines & Equipment	1,234	(6)	247.3	(1)	363.1	(9)
8. Fine Mechanics	347	(22)	72.8	(8)	46.0	(25)
9. Transport Equipment	1,629	(5)	155.4	(5)	434.3	(7)
10. Electrotechnical & Electronic Products	1,089	(7)	77.5	(7)	208.5	(13)
11. Chemicals	921	(9)	192.8	(3)	530.3	(3)
12. Construction Mats.	398	(18)	10.1	(16)	126.2	(18)
13. Glass & Ceramics	322	(23)	4.6	(21)	37.7	(27)
14. Wood	544	(14)	9.7	(18)	82.9	(19)
15. Paper	126	(32)	11.2	(15)	49.1	(24)
16. Textiles	905	(10)	39.8	(12)	183.6	(15)
17. Apparel	568	(13)	3.5	(23)	19.4	(32)
18. Leather	401	(17)	6.4	(20)	31.4	(29)
19. Meat	164	(28)	12.7	(14)	35.3	(28)
20. Other food	352	(21)	20.9	(13)	133.2	(17)
21. Other Ind's	217	(26)	9.0	(19)	28.5	(30)
22. General Construction	173	(27)	0.5	(28)	13.7	(35)
23. Construction for Production of Services	431	(16)	1.8	(24)	44.3	(26)
24. Specialized Constr.	256	(24)	0.04	(30)	24.9	(31)
25. Other Construction	97	(33)	0.02	(31)	17.21	(34)
26. Plants	2,359	(2)	47.8	(11)	493.0	(4)
27. Livestock	1,870	(4)	3.9	(22)	234.4	(12)
28. Agric. Services	66	(34)	0.0		18.5	(33)
29. Forestry	360	(20)	1.7	(25)	75.4	(22)
30. Transport & Communication	3,429	(1)	51.1	(10)	1,698.2	(1)
31. Trade	597	(12)	0.4	(29)	54.6	(23)
32. Material Services	397	(19)	1.4	(26)	156.6	(16)
33. Housing	37	(35)	0.0		447.3	(5)
34. Education	14	(37)	0.0		2.3	(37)

Table 4.8 (Continued)

35. Arts & Culture	5	(39)	0.0	1.3	(39)
36. Health	15	(36)	0.0	1.6	(38)
37. Recreation & Tourism	9	(38)	0.0	3.4	(36)
38. Other Nonmaterial Services	147	(31)	0.0	77.0	(21)
39. Science, Technology & State Services	157	(29)	0.0	79.2	(20)
Total Effects	24,271		1,534.7	8,231.6	

Note: The calculations are based on the 1977 official Polish input-output table.

capital requirement calculations are important because they reflect the need of the economy to rely on relatively scarce resources to satisfy the increase in final demand. The employment effect can be either viewed as a beneficial effect that eliminates the disguised unemployment and underemployment, or a potential problem highlighting the shortages of labor that would occur if final demand increased. However, given the low order of magnitude, the employment effect doesn't play a major policy part in our calculations and we focus on the import and, to a lesser extent, the total capital requirement effects corresponding to a simultaneous one percent increase in the exports of all industries. Table 4.7 shows that in 1969 the largest import effect was displayed by the electromachinery industry (1), followed by metalurgy (2), chemicals (3), fuel and energy (4), agriculture (5), and food industry (6). The same industries, together with transportation and services, also registered the highest total capital requirement corresponding to a one percent increase in exports.

Table 4.8, which provides the same results for 1977, shows that the most import - intensive industries are again machines and equipment, metallurgy, chemicals, fuel production, transport equipment, electrotechnical and electronic products and mechanical and metal products. The capital requirement is again ranked rather similarly, thus leading to similarities both over time and across import and capital requirements.

4.4 Summary and Conclusions

An examination of the allocation of Poland's imports of Western technology between 1972-77 reveals the following ranking: Engineering (1), chemicals (2), metallurgy (3), light industry (4), food and tobacco (5), power and fuel (6), construction (7), wood and paper (8), minerals (9), agriculture (10), and printing (11). [Fallenbuchl (1983). The priorities of this supply-side policy

deviate in many important respects from the industry rankings that we have identified from the standpoint of an effective demand-oriented strategy. In particular, our calculations suggest that in the early 1970s as well as more recently, demand stimulating policies should have been geared primarily towards metallurgy, food, agriculture, light industries and construction. The high import requirements of engineering and chemicals detected in Tables 4.7 and 4.8 especially warn against an excessive reliance on these industries. The policy adopted by the Polish authorities in the early 1970s thus reflects a rather risky strategy based on the promotion of sectors with high import content and often low linkage effects. The relative neglect of agriculture, on the other hand, appears to be the single most important omission of the supply-oriented policy. Assigning priorty to this would have made sense from both the demand and supply side perspective.

Since our calculation of linkages focused on the impact of an export stimulating policy on output and income, it is worth reporting whether the high linkage industries experienced the fastest rates of growth of exports. An examination of the constant price export data during the 1972-77 period indicates that the highest annual rate of increases was experienced by minerals (11.8%), engineering (9.3%) and light industry (6.3%). The 1960-83 data indicate that export growth was important in engineering (23.7%), chemicals (10.7%), minerals (8.1%), metallurgy (8.1%) and light industry (6.5%). The ranking of industries on the basis of the total interindustry linkage in percentage terms (giving the total output effect of a one percent increase in exports of each industry) indicates that the highest ranked industries were engineering, food, metallurgy, light industry, and fuel and energy. The strong export growth in engineering, metallurgy and light industry was hence highly conducive to overall economic growth while the relatively rapid export growth in

chemicals (1960-83) and minerals did not translate into economic growth due to limited interindustry linkages. The actual export performance can thus be judged as not greatly erroneous but clearly not optimal from the perspective of economic growth.

References

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Appendices to Chapters 1 and 2

Appendix 1.1

Major License Agreements Signed by Poland
1965-1980

Industry	Western Supplier
Engineering Industry	
I. Transport Equipment	
a. Motor vehicles	
1. compact cars (including motor vehile engines)	FIAT, Italy
2. short distance bus	BERLIET, France
3. heavy trucks	STAYER-DAIMLER-PUCH, Austria
4. heavy trucks	VOLVO, Sweden
5. engine (for trucks)	LEYLAND, Great Britain
6. gear boxes, steering gear engine break (for trucks)	ZAHNRADFABRIK, West Germany
7. diesel engines (for trucks)	HENSCHEL, West Germany
8. starters	BOSCH, West Germany
9. friction linings	TEXTAR, West Germany
10. preumatic breakings	WESTINGHOUSE, United States
11. heavy trailers	NICOLAS, France
b. Others	
1. light transport plane (medical and passenger)	PIPER, United States
2. light helicopter	DETROIT ALLISON, United States
3. aircraft engines	RHEINSTAHL-HENACHEL, West Germany
4. aircraft engines	LEYLAND, Great Britain
5. aircraft engines	VULKAN, United States
6. aircraft accessories	FIAT, Italy
7. marine turbines	SULZER, Switzerland
8. marine turbines	KAWASAKI, Japan
9. marine engine	M.A.N., West Germany
10. diesel ship engines	BURMEISTER AND WAIN, West Germany
II. Machinery Non-Electric	
a. Various Machinery	
1. concrete mixer components and concrete containers	STETTER, West Germany
2. high-pressure safety valves	POPP UND REUTHER, West Germany
3. chemical equipment	MITSUI, Japan
4. boilers	VEREIGN KESSELWERKE, West Germany

a. Various Machinery (Continued)

6.	mining machinery	VÖEST-ALPINE, Austria
7.	combined cutter loaders	KLÖCKNER-BECORIT, West Germany
8.	works transport and high-stacking storage equipment	BABCOCK-WILCOX, Great Britain
9.	automatic electroplaters	OXY METAL IND., Great Britain
10.	electroplating automatics	BRENTFORD, Great Britain

b. Machine Tools

1.	electrically-driven industrial robots	ASEA, Sweden
2.	lathes	WEWAG, West Germany
3.	metal-working machinery	ECKERT-ZIEGLER, West Germany
4.	NC machine-tools (six spindle automatics)	GILDEMAISTER, West Germany
5.	centerless grinders	MALCUS, West Germany
6.	car-body presses	SCHULER, West Germany
7.	cylindrical grinders	SCHAUDT, West Germany
8.	universal sharpeners	TACHELLA, Italy
9.	cylindrical grinders	LANDIS-GENDRON, France
10.	unit-construction machines	LA SALLE, France
11.	planer mills	WALDRICH, West Germany
12.	injection moulding machines for metals	WOTAN, West Germany
13.	tools from sintered carbide	MECMAN, Sweden

c. Building and Construction Machinery

1.	cranes	STATTER UND MENSCH, West Germany
2.	cranes	JONES AND COLES, Great Britain
3.	caterpilar tractors, loaders caterpilar bulldozers, pipe-layers	INTERNATIONAL HARVESTERS United States
4.	high-power diesel engine	INTERNATIONAL HARVESTERS United States
5.	transmission gear	INTERNATIONAL HARVESTERS United States
6.	heavy duty axles	CLARK, United States
7.	hydraulic excavators and depth drilling	KOEHRING, West Germany
8.	hydraulic excavators	COLMAR, Italy
9.	trawersing and slewing gear for excavators and cranes	LOHMANN STOLTERFOCHT, West Germany

III. Agricultural Machinery

1.	gearbox for rotary plows	MUARD, France
2.	tractors and related tractor equipment	MASSEY-FERGUSON-PERKINS Great Britain
3.	centrifuges and heave tippers	ALFA-LAVAL, Sweden
4.	double-row potato harvester	NIEWOEHNER, West Germany
5.	sugar-beet harvester	KLEINE, West Germany
6.	high-pressure presses and rotary movers	FAHR, West Germany
7.	farming machinery components	CRAMMER, West Germany

IV. Electric Machinery and Electronics

a. Television, Radio Receivers and Sound Recorders

1.	color television	THOMSON, France, and RCA, United States
2.	television screens	CORNING, United States
3.	black and white television sets	TELEFUNKEN, West Germany
4.	cassette-tape recorder	THOMSON, France
5.	radio receiver	GRUNDIG, West Germany
6.	tape recorder	GRUNDIG, West Germany
7.	loud speakers	THOMSON, France
8.	amplifiers	THOMSON, France
9.	television sub-assemblies	THOMSON, France

b. Computer Equipment

1.	IR 15-80 computer system	WESTINGHOUSE, United States
2.	equipment for computer monitor system	STANSAAB ELECTRONICS, Sweden
3.	integrated circuits	FERRANTI, Great Britain
4.	third-generation computer	INTERNATIONAL COMPUTERS LTD, Great Britain
5.	abrasive discs	MORTON, United States
6.	data terminals	STANSAAB ELECTRONICS, Sweden
7.	industrial process control systems	HONEYWELL, United Stated
8.	semiconductors and circuit brakers	WESTINGHOUSE, United States
9.	ceramic semiconductors and condensors	THOMSON, France

IV. Electric Machinery and Electronics

b. Computer Equipment (Continued)

10. active and passive electronic sub-assemblies	THOMSON, France
11. subminiature quartz resonators	IBM, United States

c. Telecommunication Equipment

1. telecommunication cables	SAT-SARETE, France
2. exchange system (E-10)	C.I.T., France

d. Electrical Tools

1. electrical tools	BOSCH, West Germany

e. Energy Generation Equipment

1. energy power equipment	STAL-LAVAL, Sweden
2. turbines 360 MW	BROWN BOVERI, Switzerland
3. nuclear power station turbines	BROWN-BOVERI, Switzerland
4. turbines 600 MW	BROWN-BOVERI, Switzerland
5. turbines 125 MW	ASSOCIATED ELECTRIC IND., Great Britain
6. power generating equipment	SVENSKA ROTOR MACHINER Sweden
7. power generating equipment	BABCOCK-WILCOX, Great Britain
8. transformers	ELINA, Austria
9. transformers 425 MVA	HITACHI, Japan
10. transformers	SIEMENS, West Germany
11. high voltage air-brake circuit brakers	BROWN-BOVERI, Switzerland
12. high frequency generators	RADYNE, Great Britain

f. Home Appliances

1. sewing machines	SINGER, United States
2. typewriters (manual and electric)	FACIT, Sweden
3. mixers	ROTEL, West Germany
4. refrigerator	ZANUSSI, Italy

IV. Electric Machinery and Electronics

f. Home Appliances (Continued)

5.	small washing machines	BLOMBERG, West Germany
6.	food processors	BAUKNECHT, West Germany
7.	home appliances	GENERAL ELECTRIC, United States
8.	teflon pots	DU PONT, United States
9.	refrigerating absorption units	TELEFUNKEN, West Germany

V. Metallurgy

1.	steel rolling	WATERBURY FARELL, United States
2.	corundum products	ALFRED HEMPEL KG, West Germany
3.	brass and copper strip	WATERBURY FARELL, United States
4.	zinc and lead smelting furnace	IMPERIAL SMELTING, Great Britain
5.	controlled atmosphere and vacuum heat treating furnaces	IPSEN, United States
6.	concentrate suspension melting process	OUTOKUMPU, Finland
7.	protective coatings	O. DURR, West Germany

VI. Chemicals

a. Basic Chemicals

1.	soda ash	KREBS KLOCKNER, West Germany
2.	coal gasification	KRUPP, West Germany

b. Petrochemicals

1.	pesticides (potato bettle poison)	SHELL, Great Britain
2.	herbicides	SHELL, Great Britain
3.	textile fibers	PHONE POULENC, France
4.	fertilizers (ammoni and urea)	CREUSOT LOIRE, France
5.	PVC, VCM and chlorine	PETROCARBON LTD, Great Britain
6.	melamine (resins)	CHEMIELINZ-VÖEST-APLINE, Austria
7.	phosphate	OCCIDENTAL PETROLEUM, United States
8.	nylon	TORAY IND., Japan
9.	polystyrene foam	SHELL, Great Britain
10.	lubricating oils	F.L. SMIDTH, Denmark
11.	oil refining	SNAM, Italy

VI. Chemicals (Continued)

c. Pharmaceuticals

1. medical preparations	SQUIBB, United States
2. combantrin, mecadox	PFITZER, West Germany
3. medical preparations	MCKEE, United States

d. Others

1. floor coverning	PEGULAN WERKE, West Germany
2. tires	SEMPERIT, Austria

VII. Other Industries

a. Food Processing

1. Coca Cola	COCA COLA, United States
2. cigarettes	MARLBORO, United States
3. chocolate	VAN HOUTEN, Netherlands

b. Textiles and Footwear

1. ladies shoes	ALSA, West Germany
2. shoes	KATHY IND., United States
3. clothes presses	SIEMENS, West Germany

c. Construction Industry

1. prefabricated houses	BYGGNADS AB, Sweden
2. silicate bricks	KRUPP, West Germany
3. cement	F.L. SMIDTH, Denmark

Appendix 1.2

Major License Agreements Signed by Hungary 1965-1980

Industry	Western Supplier
Engineering Industry	
I. Transport Equipment	
1. Buses	VOLVO, Sweden
2. Shock absorbers	GRILING, Great Britain
3. Axels	ROCKWELL, United States
4. Power-assisted steering gear	ZF, West Germany
5. Diesel engine (for lorries & trucks)	MAN, West Germany
6. Brake system	KNORR, West Germany
7. Starter	BOSCH, West Germany
8. Small cross-country car	VOLVO, Sweden
9. Distributors	BOSCH, West Germany
II. Machinery Non-electric	
a. Various machinery	
1. Boiler and crane	BBC, Switzerland
2. Pallet loaders	FLYGT, Sweden
3. Gas turbine	BBC, Switzerland
4. Combustors	GHELFI, Sweden
5. Boilers	BABCOCK, West Germany
6. Hydraulic dregers	MENGELE, West Germany
7. Washing-drying facilities for passenger cars	AMANUEL, CO., Italy
8. Non-clogging pumps	FLYGT, Sweden
9. Presses (for the rubber and plastic industries)	WERNER-PFLEIDER-STUTTGART West Germany
b. Machine-tools	
10. NC boring mills	RUTTER-FOREST, France
11. CNC turning lathes	KRUPP, West Germany
12. NC lathes	GILDMEISTER, West Germany
13. NC thread grinders	MATRIX, Great Britain
14. Milling machines	FRITZ WERNER, West Germany
15. Pneumatic and hydraulic components for machine tools	MECMAN, Sweden
16. Modern fitting tools	BOSCH, West Germany
17. Hand tools and machines	BLACK & DECKER, Great Britain
c. Instruments and medical equipment	
18. Medical appliance and instruments	SIEMENS, Austria
19. Blood analyzer	RADELKIS CHEMICAL INSTRUMENTS CO., CORNING CO., United States
20. Universal measuring instruments	GOERTZ ELECTRIC CO., West Germany

21.	Electrical laboratories and instruments	HERA, West Germany
22.	Vehicle instruments (for buses, lorries and passenger cars)	V.D.O., West Germany
23.	Gas station equipment	GAVAZZI CO., Italy
24.	Instrument panels for passenger cars	BORLETTI, Italy
25.	Price-indicating scales	FLORENZ, Austria

III. Agricultural Machinery

1.	High-performance (garden) tractors	STEIGER TRACTOR WORKS, United States
2.	Agricultural machinery	HESSTON CO., United States

IV. Electric Machinery and Electronics

a. Television equipment

1.	Colour monitors	THOMSON CFS, France
2.	Colour television	STANDARD ELECTRIC LOREN, West Germany
3.	Television engineering and studio equipment	BOSCH, West Germany
4.	Picture and sound mixing tables	SIEMENS, Austria

b. Computer equipment

5.	Magnetic tapes	MENGELE, West Germany
6.	Printed circuit interfaces	THOMSON, France
7.	Computer system	THOMSON, France
8.	Minicomputers	SAAB-SCANIA, Sweden
9.	10010-type computer	C11, France
10.	Magnetic disc memories (floppy disc)	SAGEM, France
11.	Integrated circuitry	FAIRCHILD, United States
12.	Line-printer screen	AMERICAN DATA PRODUCTS CORP., United States

c. Sound recorders

13.	Cassett type recorder	WOELKE, West Germany
14.	L.H. super cassett recorder tapes	BASF, West Germany
15.	Adhesive tapes	JOHN-MANVILLE de FRANCE, France
16.	Sound - boxes	AKAI, Japan

d. Telecommunication equipment

17.	Coaxial cables	SAT, Sweden
18.	Transmission lines	ERICSON, Sweden
19.	Cross bar telephone exchange systems	ERICSON, Sweden
20.	High-tension switches	BBC, Switzerland
21.	Welding wires	ESAB, Sweden
22.	Automatic regulation valves	BOOLZ, West Germany
23.	Magnetic contractors	KLOCKNER-MULLER, West Germany
24.	Vacuum circuit breaker	HITACHI, Japan
25.	Mosaic fuses	SIEMENS, Austria

e. Freezing equipment

26.	Compressor-type refrigerators	BOSCH, West Germany
27.	Refrigerating equipment	SIEGMUND CO., West Germany
28.	Absorbtion refrigerator	SIBIR, Switzerland
29.	Refrigerating and deep-freezing counters and non-refrigerated equipment for supermarkets	TYLOR, Great Britain

f. Other electric equipment

30.	Typewriters	TRIUMPH-ADLER, West Germany
31.	Typewriters (portable & office)	MERMES, Switzerland
32.	Rotary-drum regenerative air heaters	LJUNGSTRUM, Sweden
33.	Transformer	GENERAL ELECTRIC CO., United States
34.	Automatic washing machines	TELEFUNKEN, West Germany

V. Metallurgy

1.	Light building sturctures	FILLOD, France
2.	Modern aluminum foils	PECHING, France
3.	Metallurgy of non-ferrous metals	KIESERLING, West Germany
4.	Spirally welded pipes	KOCKS, West Germany
5.	Tube mill and rolling mill equipment	KIESERLING, West Germany
6.	Window iron works	W. FRANK, West Germany

VI. Chemicals

a. Basic chemicals

1.	Organic components	EMINENT, Netherlands
2.	Polypropylen	HERCULES, United States
3.	Monochlore - acetons acid	SUMITOMO, Japan
4.	Catalytic cracking	PROCOFRANCE CO., France
5.	Polyethylene	ICI, Great Britain
6.	Pigments	ICI, Great Britain
7.	Olefins	SHINETSU, Japan
8.	Fertilizers	KING, Great Britain
9.	Herbicides	ICI, Great Britain

b. Pharmaceuticals

10.	Medical preparations	SANDOZ, Switzerland
11.	Medical preparations	CIBA-GEIGY, Switzerland
12.	Medical preparations	ELI LILLY, United States
13.	Medical preparations	BEIERSDORF COMP., West Germany
14.	Medical preparations	SANSEN, Belgium

c. Others

16.	Tires	SEMPERIT, Austria
17.	Tires (textile radicals)	GOODRICH, United States
18.	Oil-resistant rubber gloves	BRITISH PETROLEUM, Great Britain
19.	Auxiliaries for transport equipment	TERESON CO., West Germany
20.	Industrial surface protection	KING, Great Britain
21.	Cassett-type perforated profile	COVERNA CO., Italy
22.	Plastic-based facade painting agent	INDULA, West Germany
23.	Adhesive for carpets	WEGSCHEIDER, Austria
24.	Floor furnishing materials	WOERMANN, West Germany
25.	Teflon-lined kitchen utensils	DUPONT, United States

VII. Other Industries

a. Food processing

1.	Food eel-raising	B.P. UTILIZATION LTD., Great Britain
2.	Beef products	CONTRACTOR, Netherlands
3.	Food preserving	NESTLE, Switzerland
4.	Long-life cream, fresh cheeses etc.	GERVALIS DANONE, A. G., West Germany
5.	Coca-cola	COCA-COLA, United States
6.	Seed processing (cooking oil)	KRUPP, West Germany
7.	Boilers using mixed feed	BERTSCH, Sustria
8.	Traubisoda	LENZ-MOSER, Austria

b. Textiles and footwear

9.	Sport shoes	ADIDAS, France
10.	Shoes	KATHY CO., United States
11.	Overlather technology	COSTIL, France
12.	Jeans	LEVI STRAUSS CO., United States
13.	Gorsetry and other linegerie	TRIUMPH, Austria

c. Others

14.	Camping outfits	BRENTMAIL, Great Britain
15.	Hard glass containers	CORNING CO., United States
16.	Soap	SCHWARZKIPF, West Germany

Appendix 1.3

Transfer of Western Technology to Czechoslovakia, 1965-1980

Industry	Supplier
Engineering Industry	
I. Transport Equipment	
a. Motor Vehicles	
1. car window control	GOLDE, Austria
2. automobile halogen lamps	BADER, West Germany
3. heavy duty gears	STAVER, West Germany
4. radiators	FERODO, France
5. body-welding line	RENAULT, France
6. charges (<300 kw capacity)	KUHNLE, West Germany
7. diesel engine pumps	KUHNLE, West Germany
2. Others	
1. cable cars	POMAGALSKI, France
II. Machinery Non-Electric	
a. Various Machinery	
1. steel boilers	BUDERUS, West Germany
b. Machine-Tools	
1. telescopic guards	KABELSCHLEP, West Germany
2. die-cutting machines	SCHULLER, West Germany
3. super-finish machines	THIELENHAUS, West Germany
4. grinding machines (for automotive industry)	CONSTRUCTIONS de CLICHY, France
c. Building and Construction	
1. hydraulic excavator	POCLAIN, France
2. electrostatic dust filter	ELEX, Switzerland
3. current pumps	PUTZMEISTER, West Germany
III. Agricultural Machinery	
1. silos	MV-FABRIK, West Germany
2. milking system	ALFA-LAVAL, Sweden
3. [illegible]	HOBO, Belgium
4. refrigerated milk tanks	

Industry	Supplier
IV. Electric Machinery and Electronics	
a. Television, Radio Receivers and Sound Recorders	
1. commutator KR-10	RADIO-ELECTRO-SELECTION, France
b. Computer Equipment	
1. programmers (for washing and diswashing machines)	SIEBEL, France
2. air conditioners for computers	HIROS DENCO, Siechtenstein
c. Others	
1. direction indicator switches	LUCAS, Great Britain
2. restaurant dish-washing machines	HILDEBRAND, West Germany
3. thermoreactive insulation	SIENENS, West Germany
4. pumps for 500 MV aggregates	WEIP, West Germany
V. Metallurgy	
1. steel cords for tyres	GCRE, Italy
2. material from COR-steel	JSW, Japan
3. sintering pan	THYSSEN, West Germany
4. steel band sorting line	WEAN-DAMIRON, France
VI. Chemicals	
a. Petrochemicals	
1. benzene	AIR PRODUCTS, United States
2. polyamide fibers	AKZO, Holland
3. nylon	ALLIED CHEMICALS, United States
4. ethylene oxide	AMTEL, United States
5. trichloroethylene	ELECTRO-PAINT, Great Britain
6. plastic pipe	GEBRUDER ANGER, West Germany
7. synthetic fibers	NISSHO-IWAI, Japan
8. polyethylene	SIM-CHEM., Great Britain
9. LD polyethylene	VENOT-PIC, France
b. Pharmaceuticals	
1. cosmetics	CHRISTIAN DIOR, France
2. hoof and mouth disease vaccine	BELLON, France
c. Others	
1. calcium nitrate	GRILL-GROSSMAN, France
2. granulated fertilizer	KALTENBACH, France
3. introcellulose lacquer	LACKWEREKE WULFING, West Germany

Industry	Supplier
c. Others (continued)	
4. porous rubber packing	SAIAG, Italy
5. anti-knock additive for gasoline	WEREKE HULLS, West Germany
Other Industries	
a. Food processing	
1. skis	HAGAN, Austria
2. jar caps	V.V. INTERNATIONAL, Spain
b. Textiles and Footware	
1. microcreping of material	BANCROFT, United States
2. sanforizing	CLUETT-PEABODY, United States
3. molded footware	BRITISH RUBBER, Great Britain
c. Construction Industry	
1. prefabricated building units	LARSEN-NIELSEN, Denmark
2. white cement	SMIDTH, Denmark
3. prefabricated chimney system	SCHIEDEL, West Germany

Appendix 2.1

Imports of Machine-Tools for Metal Cutting
Poland, 1970-1983

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
						a) values (in million zloty)								
1. Total imports	301	244	398	597	621	723	1138	1066	1113	845	612	-	-	-
						b) quantities (in thousand units)								
1. Total imports														
in which:	4.8	3.9	5.7	9.3	10.2	11.6	12.9	9.7	7.8	6.6	5.9	5.1	4.0	5.8
from western countries	0.5	0.7	1.2	2.1	3.1	4.0	3.5	2.8	1.3	1.4	0.9	0.8	1.2	0.7
(Percent of the total)	10%	18%	20%	23%	30%	35%	27%	29%	16%	21%	15%	15%	30%	12%

Source: Compiled from Rocznik Statystyczny GUS (Warszawa: GUS), various years.

Appendix 2.2

Imports of Machinery and Equipment for Metallurgy Industry, Poland, 1970-1983

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
						a) values (in zloty)								
1. Total imports in which:	60	147	236	235	535	793	983	614	820	527	696	-	-	-
from western countries	-	-	-	157	425	538	648	453	685	365	271	-	-	-
(percent of the total)	-	-	-	67%	79%	68%	66%	74%	83%	69%	39%	-	61%	69%
						b) quantities (in thousand tons)								
1. Total imports in which:	7.0	-	-	20.8	49.8	59.7	72.0	39.9	40.7	27.8	39.6	27.1	8.2	4.2
from western countries	-	-	-	-	-	-	-	-	-	-	12.2	8.4	4.4	2.5
(percent of the total)	-	-	-	-	-	-	-	-	-	-	30.8	30.9	53.6	59.5

Source: Compiled from Rocznik Statystyczny GUS, (Warszawa: GUS), various years.

Appendix 3.1

Market Shares of Eastern European Countries
in the Western European Imports

	1970	1975	1979	1980	1981	1982	1983
Eastern Europe in which:	2.43	2.35	2.17	2.07	1.88	1.90	1.90
Poland	0.56	0.65	0.55	0.51	0.35	0.36	0.36
Bulgaria	0.15	0.08	0.10	0.09	0.09	0.09	0.08
Czechoslovakia	0.39	0.34	0.29	0.28	0.27	0.28	0.28
East Germany[1]	0.65	0.64	0.58	0.59	0.61	0.65	0.66
Hungary	0.30	0.28	0.29	0.27	0.25	0.24	0.25
Romania	0.38	0.36	0.36	0.33	0.31	0.28	0.27
Eastern Europe excl. Poland	1.87	1.70	1.57	1.56	1.53	1.54	1.54

Note: 1 - Including Intra-German trade.

Source: Eurostat, Analytical Tables of Foreign Trade, NIMEXE, various years.

Appendix 4.1

Total Exports and Combined Exports of Chemicals (SITC-5) and Machinery and Transport Equipment (SITC-7) from Eastern Europe to the OECD. (in million dollars, current prices)

	1970			1975			1979		
	Total	S-5,7%		Total	S-5,7%		Total	S-5,7%	
Poland	1061	112	10.5	3174	486	15.3	5057	904	17.9
Bulgaria	240	35	14.6	392	86	21.9	915	141	15.4
Czechoslovakia	723	174	24.0	1642	384	23.3	2757	641	23.2
East Germany	410	159	38.8	1034	399	38.4	1641	596	36.3
Hungary	536	62	11.5	1250	206	16.5	2547	543	21.3
Romania	554	66	11.9	1692	206	12.2	3267	366	11.2
Eastern Europe	3524	608	17.2	9189	767	19.2	16184	3191	19.7

Source: Calculated from Foreign Trade by Commodities (Paris: OECD, 1982).